Unication

ALPHA GOLD

SERVICE MANUAL

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GENERAL

Contents

About This Publication 1-1
Audience 1-1
Finding Information 1-1
Conventions 1-2
Revisions 1-2
Specifications 1-3
Product Overview 1-4
Product Names 1-4
Display 1-4
Housing 1-4
Features 1-4
Addressing 1-5
Controls and Indicators 1-5
Paging Operation 1-11
Features and Options 1-11
Operating Instructions 1-21
Theory of Operation 1-24
Operating Power 1-24
General Circuit Description of Dual Conversion POCSAG Pagers 1-25
Maintenance 1-27
Removing the Battery 1-27
Replacing the Battery 1-28
Removing the Back Cover 1-28
Removing the Receiver Board 1-30
Removing the Snubber Pad 1-31
Removing the Decoder Board 1-32
Removing the Vibrator Motor 1-32
LCD Module Removal 1-33
LCD Module Replacement 1-34
Troubleshooting 1-37
Test Equipment 1-37
Preliminary Checklist 1-38
Self-Diagnostic Feature 1-39
RF Trouble Shooting 1-47

About This Publication

Using this service manual and the many suggestions contained in it assures proper installation, operation, and maintenance of Unication Alpha Gold pager. Refer any questions about this manual to the nearest Customer Service Representative.

Audience

This Service Manual is provided to assist service personal in the test and repair of Unication Alpha Gold pager. Service personal should be familiar with electronic assembly test methods, troubleshooting, operation and the use of associated test equipment.

Finding Information

This manual provides descriptive data and service information for Unication Alpha Gold pager. A pager's product family is identified by the first three digits of the pager serial number, unless the pager is covered by an extended warranty. Extended warranty pagers have two alphabetic characters in place of the first two digits of the product family code. The first digit is following the alphabetic code indicates the number of years the warranty period is in effect.

Where information in this publication is specific to a type of pager, it is indicated; otherwise, information is pertinent to all Alpha Gold pager. In this publication, pager types are identified as:

- POCSAG
  - POCSAG 1
  - POCSAG 2

A pager type is determined by locating the pager model number in a model number chart and referring to the pager type specified in the chart title.

Schematic diagrams, parts lists, and printed circuit board layouts are contained in supplementary manuals.

This Service Manual consists of the following sections:

- General - Describes the product families, their features and options, and theory of operation. Also, provided are procedures for disassembling, troubleshooting, and repairing Unication Alpha Gold pager.
- Decoder - Provides decoder-specific circuit descriptions and troubleshooting flowcharts.
- Receivers - By frequency band, provides receiver-specific circuit descriptions, alignment procedures, troubleshooting flowcharts, and model number charts.

Schematic diagrams, parts lists, and printed circuit board layouts are contained in supplementary manuals.

Conventions

Special characters and typefaces, listed and described below, are used in this publication to emphasize certain types of information.

Q234	This typeface is used to emphasize circuit board component reference designators.
OFF	This typeface represents text displayed on the pager LCD.
	Note: Emphasizes additional information pertinent to the subject matter.
	Caution: Emphasizes information about actions that may result in equipment damage.
	Warning: Emphasizes information about actions that may result in personal injury.

Revisions

Any changes that occur after manuals are printed are described in Publication Manual Revision (PMR) bulletins. These bulletins can include a listing of new parts, changes to schematic diagrams and printed-circuit board layouts, and so on.

Specifications

Paging Sensitivity:	Refer to specific receiver information.
Spurious & Image Rejection:	Refer to specific receiver information.
Frequency Stability:	Refer to specific receiver information.
EIA Selectivity:	Refer to specific receiver information.
Memory Capacity:	Refer to Table 1-2.
Alert Tone Frequency:	3200 Hz standard alert with user selectable alerts
Alert Tone Duration:	2 or 12 seconds programmable
Alert Tone Loudness:	78 dB minimum, at 30 cm (12 inches)
Power Consumption:	Refer to specific receiver information.
Battery:	One 1.5V, AA-size alkaline
Battery Life:	Refer to specific receiver information.
Weight (with battery):	87 grams (approximate)
Size:	81.0 x 55.0 x 18.5 mm
	POCSAG 1 and 2:
Code Format:	31/21 POCSAG Code (CCIR Code #1), 512, 1200, and 2400 bps
Channel Spacing:	25 kHz
Frequency Deviation:	±4.5 kHz

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE

Product Overview

The Unication Alpha Gold pager are miniature, microcomputer-controlled FM receivers with graphic liquid crystal display (LCD). They are powered by a single AA-size battery.

These pagers use either Post Office Code Standardization Advisory Group (POCSAG) or FLEX paging format. Refer to the applicable receiver section in this manual for information about which format is used with each frequency range.

Product Names

Product name is on the front cover.
Product names are subject to change without notice. Some product names, as well as some frequency bands, are available only in certain markets.

Display

The pagers' large LCD displays:

- 80 alphanumeric characters in dot-matrix patterns of 5 columns by 7 rows
- 14 ideographic Simplified and Traditional Chinese characters, in dot-matrix patterns of 15 columns by 16 rows
- 28 ideographic Thai characters, in dot-matrix patterns of 8 columns by 16 rows

Housing

The pager is housed in an impact-resistant plastic case that offers excellent protection against dust intrusion, vibration, and shock. Small in size and lightweight, the unit can be clipped to your belt or fit comfortably in a shirt or jacket pocket.

Features

These pagers use the most advanced custom integrated circuits to perform the complex functions for radio paging. Aside from the space and weight advantage, microcircuits enhance basic pager reliability, simplify maintenance, and provide a wide variety of operational functions.

The following features are standard in the Alpha Gold pagers:

- **Attractive, miniature styling**
- **High-contrast, graphic dot-matrix liquid crystal display. POCSAG 2 pager have a holographic LCD.**
- **High-visibility backlighting (automatic in low-light conditions)**
- **Microcomputer control with advanced software algorithms**
- **PrivateTime**
- **Low battery indicator**
- **Real-time clock with time, date and alarm**
- Non-volatile message memory with time and date stamp
- **Single AA-size battery**
- **User-selectable alert screen with seven pleasing alert tones, chirp alert, standard alert, and no alert**
- **Intelligent function menu selections with prompts, icons or both**
- **Zoom in , Zoom out**

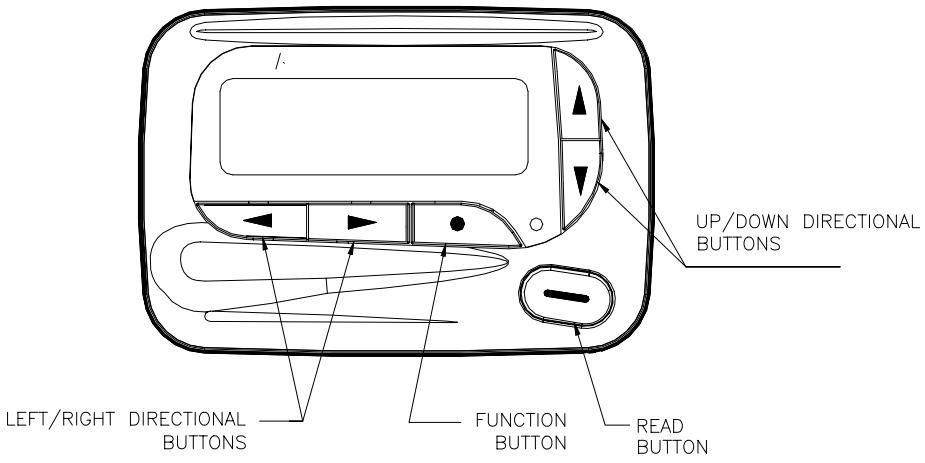
Addressing

Each pager can be programmed for multiple personal, group, or maildrop addresses by using the appropriate PPS and Pager Mechanical Interface.

Unication Alpha Gold pager respond to modulation consisting of a sequence of binary digital "words." When the transmission matches the address information stored in the codeplug, the pager responds with an audible tone alert or a vibrating alert, depending on the programmed options and the user-selected mode of operation. In addition to the tone or vibrating alert, the pager also displays a message.

Controls and Indicators

The pager controls are the six buttons located on the front of the pager (refer to Figure below). Indicators, in the form of icons, are displayed on the LCD. The following paragraphs describe the controls and indicators.



The location and size of the Unication logo may vary for different models of the pager.

Liquid Crystal Display (LCD)

The four-line LCD provides a high contrast dot-matrix display for easy readability. The LCD also features a high visibility backlight for reading the display in low-light conditions.

In the alphanumeric mode, a 4-line by 20-character dot-matrix format is used to display up to 80 characters per screen.

In the ideographic mode, a 2-line by 7-character dot-matrix format is used to display up to 14 Chinese or a 2-line by 14-character dot-matrix format is used to display up to 28 Thai characters per screen.

Table 1-1 lists the indicators, their uses, and their meanings. Certain indicators, annunciators, are displayed at the far left of the screen during pager power-up and whenever the pager is not displaying messages or menus. Other indicators are displayed on various screens as described in the following table and paragraphs.

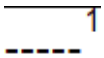
Table 0-1. Indicators

Icon	Display Location and Meaning			
	Annunciator	**Message/Status**	**Function Menu**	**Other**
	Power On	Unread Message Flashing		
			Turn Pager Off	
	Private Time Function is set to On		Enter Private Time Menu	Private Time Enabled in Private Time Screen
				Private Time Disabled in Private Time Screen
			Go to Status Screen	
			Set Audible Alert	
			Set Silent Alert	Set No Message Alert in Choose Alert screen
			Choose Alert Mode	
	Audible Alert mode is turned on			
		Alarmed Message		
			Set Message Alarm	
		Cursor on Alarmed Message		
				Alarm Enabled in Set Time or Set Message Alarm Screen
				Disable Alarm in Set Time or Set Message Alarm Screen

Table 0-1. Indicators

Icon	Display Location and Meaning			
	Annunciator	**Message/Status**	**Function Menu**	**Other**
			Set Time or Set Alarm Selector	
			Set Time and Alarm	
		Locked Message	Lock Message	
		Cursor on Locked Message		
			Unlock Message	
		Maildrop Message with Alert Enabled	Maildrop Alert On	Set Chirp Alert in Choose Alert Screen
		Cursor on Maildrop Message with Alert Enabled		
			Maildrop Alert Off	
		Maildrop Message with Alert Disabled		
		Cursor on Maildrop Message with Alert Disabled		
		Notebook Message(s)	Add to Notebook	
		Cursor on Notebook Message		
		Message in Memory		
		Cursor on Message, or New Message when flashing		
				Memory Full
			Delete Message	

Table 0-1. Indicators

Icon	Display Location and Meaning			
	Annunciator	**Message/Status**	**Function Menu**	**Other**
			Delete All Messages	
			Print Message	
			Print All Messages	
		Truncated Non-Ideographic Message		
		Non-Ideographic Message Continued		
				Alphanumeric Missing Fragment Indicator
				Long Numeric Missing Fragment Indicator
				24 Hour Time
				AM Time
				PM Time
				Full Battery
				3/4 Full Battery
				1/2 Full Battery
				1/4 Full Battery
				Low Battery
				Out of Range

Read Button (–)

The Read button is used to turn the pager on and read messages stored in memory. When the pager is off, a single push of the Read button turns the pager on (refer to Figure 1-1).

As the pager is turned on, it displays the Power-up screen and generates the Power-up alert (refer to Figure 1-2).

Figure 1-2. Power-up Screen

When the pager is on, the Read button is used to display the Message/Status screen (refer to Figure

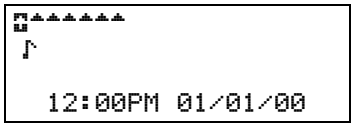


Figure 1-3. Message/Status Screen

After eight seconds of no pager activity, the display changes to the Standby screen (refer to Figure 1-4).

Figure 1-4. Standby Screen

When the Read button is pressed to read a message, the first screen of the message is displayed until the freeze time expires or a key is pressed (refer to Figure 1-5). A Message Continued indicator (↓) indicates the message is continued. This indicator toggles with the last character of the display. If there is no character in the last character location, the indicator flashes.

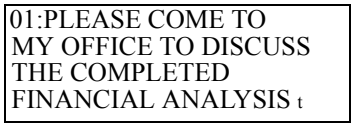


Figure 1-5. First Screen of a Message

When a message is displayed, each press of the Read button advances the display to the next four lines. The date and time a message was received is displayed at the end of the message as shown in (refer to Figure 1-6).

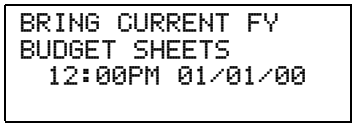


Figure 1-6. Last Screen of a Message

Pressing and holding the Read button causes a fast scroll through the message. The freeze and fast scroll times are programmable with the PPS.

When the Read button is pressed while a Function menu or a Set Function screen is displayed, the pager displays the Message/Status screen (refer to Figure 1-3) without saving any changes.

Function Button (•)

The Function button is used to activate the special functions. When the Function button is pressed, the Function menu icons and prompts are displayed on the bottom two lines of the display. The icon corresponding to the active function blinks and the appropriate prompt is displayed above it (refer to Figure 1-7). The Function button also operates the display backlighting when pressed and held for 2 seconds.

Figure 1-7. Function Menu

Left Button (◄)

The Left directional button is used to scroll to the first screen of the previous message while reading a message or to move the cursor to the left.

Right Button (►)

The Right directional button is used to scroll to the first screen of the next message while reading a message or to move the cursor to the right.

Up Button (▲)

The Up directional button is used to scroll to the first screen of the current message while reading a message or to move the cursor up. It is also used to increment the time in the Set Time and Alarm screen. When pressed and held, the Up button causes a continuous increment.

Down Button (↓)

The Down directional button is used to scroll down through a message one line at a time. It is also used to decrement the time in the Set Time and Alarm screen. When pressed and held, the Down button causes a continuous decrement.

Paging Operation

Unication Alhpa Gold pager can be configured to accept alphanumeric-display, ideographic-display pages, numeric-display, and tone-only pages. When a message is received, the pager emits a 2 or 12 second alert depending on pager programming. A new message is indicated by a flashing arrow (). After the message is stored and 8 seconds of no pager activity lapses, the display changes to the Standby screen. Also, the On annunciator icon () in the upper left-hand corner of the display flashes. Reading any part of the message removes the unread message indication (the On icon no longer flashes).

Features and Options

The following information describes features and options of the Unication Alpha Gold pager. Some pager features are programmable using the PPS. The PPS User's Guide listed in "Specifications" provides additional information about programmable features.

Table 0-2. Standard Features

Paging Feature	Pager Type	Description
	POCSAG	
Message Storage	✓	Personal Messages are located on the first line; older messages are located to the left. The last message received is always the farthest right message (except for duplicate messages). When the farthest right message slot is full and a new message arrives, all messages are shifted as far left as possible, filling in all gaps with the newest message placed to the right.
	✓	Maildrop Messages are stored in a designated slot on the second line of the display. A maildrop message sent on address or source 1 is stored in slot 1, a message sent to address or source 2 is stored in slot 2, and so on.
Personal Message Notebook	✓	Up to 255 personal messages can be stored in the Personal Message Notebook. The Personal Message Notebook is represented by on the first line of the display.
Maildrop Message Notebook	✓	Up to 255 maildrop messages can be stored in the Maildrop Message Notebook. The Maildrop Message Notebook is represented by on the second line of the display.
Automatic Message Deletion - Personal Messages	✓	When all personal message slots are occupied or there is insufficient unused personal message memory, the oldest unprotected read message is deleted to make room for the new message. If all messages are unread, the oldest unprotected, unread message is deleted.
Automatic Message Deletion - Maildrop Messages	✓	An existing message at a particular maildrop address is deleted when a new message for that address is received (except when the new message does not contain data). However, if there is insufficient unused maildrop memory, the existing message is deleted to make room for the new message, even if the new message is to be discarded. The order of deletion is: 1. Existing message on the current maildrop address 2. Right-most read maildrop address 3. Right-most unread maildrop address
Message Management	✓	When the Message Locking option is selected, the user can lock up to 10 personal messages. When the Manual Delete option is selected, the user can delete unlocked, unalarmed messages.
	✓	Alarms can be set on up to 5 messages.
Message Status	✓	Icons on the Message/Status screen indicate the status of all messages. Refer to Table 1-1 for descriptions of status indicators.
Retain Errored Non-Numeric Message	✓	When this option is selected, the pager alerts normally if errors are detected in an alphanumeric or ideographic message. If this option is not selected, the pager does not alert, and the message is not stored.

Table 0-2. Standard Features

Paging Feature	Pager Type: POCSAG	Description
Real-Time Clock and Alarm Clock	✓	Displays the time and date, time-and-date stamps all messages, and gives an alarm indication at a preset time. The time can be changed to indicate either 24-hour or AM/PM time. If 24-hour is selected, all time stamps and alarm times are displayed in 24-hour time. If AM/PM is selected, all time stamps and alarm times are displayed in AM/PM time.The alarm can be set for a daily alarm or a one-time-only alarm. When an alarm expires, the pager either vibrates or produces an audible alert depending on the selected mode.
Time-Stamping	✓	Displays the time and date a message was received at the end of that message. A screen with a typical time stamp (in U.S. format) is shown in Figure 1-6.
Individual Message Alarm	✓	Allows an alarm to be attached to a particular personal message. Alarms can be set on up to 5 messages. If an individual message alarm is set on a message, that message is denoted by on the Message/Status screen. The annunciator is also displayed, even when the pager is turned off.
	✓	When an individual message alarm expires, the cursor moves to the message, the s icon blinks, and the pager either vibrates or produces an audible alert, depending on the selected mode.
International Date	✓	Allows the pager to be programmed to display the date in either US or international format. For example, March 30, 1997 can be displayed as 03/30/97 (U.S.) or 30/03/97 (International).
Auto Alarm Turn On	✓	This feature causes the pager to automatically turn on and give an alarm alert when any type of alarm expires. The pager stays on after the alarm alert has ended.
Key Click	✓	Produces an audible click when a button is pressed if the Key Click option is selected.
Battery Removed	✓	If the battery is removed, the pager turns off immediately. When the battery is replaced, the pager powers up after a 2-second pause.
Battery Gauge	✓	Displays a battery gauge indicator (see Table 1-1) on the third line of the display. The battery condition percentages are programmable values and vary with battery type.
Low Battery Indication	✓	Displays a battery warning indicator (or). If the Low Battery Alert option is selected, the pager will also alert. The following takes place while the low battery condition exists: 1. Manual or 12-second audible or vibration alerts are reduced to 2 seconds. 2. Two-second audible or vibration alerts are reduced to 1 second. 3. Backlight cannot be turned on. Chirp alerts are unaffected by the low battery condition.

Table 0-2. Standard Features

Paging Feature	Pager Type: POCSAG	Description
Memory Retention	✓	If the Non-Volatile Memory option is selected, all messages and pager settings remain in memory when the pager is turned off. If the option is not selected, messages and settings are lost when the pager is turned off. *To ensure proper memory retention, turn the pager off before removing the battery. Immediately replace the old battery with a new battery.*
Automatic Alert Reset	✓	Alerts are typically stopped by a button press or by timing out. If the Manual Alert Reset option is selected (see Table 0-5), the message alert does not stop automatically, but waits for a key-press to stop. The Manual Alert Reset option applies only to personal and priority alerts while the pager is in the audible mode. It does not apply to maildrop, alarms, reminder alerts or when the pager is in the vibrate mode.
Battery Saver	✓	Three battery-saving techniques are used by the pager: 1. The microcomputer activates the receiver circuitry for only a short period of time to search for an incoming page and then turns the receiver off for a set duration. 2. Part of the display is turned off after 8 seconds of no pager activity. During this time, only the annunciator icons are displayed. See Table 1-1 for information about the annunciator icons. 3. The microcomputer clock rate is slowed when there is no pager activity.
Memory Full Indication	✓	Displays when there are too few character spaces available in the pager's personal message memory or when all personal message slots are occupied. If the next incoming personal message has more characters than the number of available spaces in pager memory, the new message overwrites the oldest message.
	✓	The Memory Full Prompt is a programmable option.
	✓	Displays when there are fewer than 135 character spaces available.
User Selectable Alerts	✓	Allows the user to choose a standard alert or one of seven pleasing alerts via the Choose Alerts screen. The last pleasing alert listed in the Choose Alert screen is a programmable pleasing alert. Refer to Table 0-5 for more information about programmable pleasing alerts. The standard or pleasing alert selected on the Choose Alerts screen applies to incoming non-priority personal messages and the power-up alert. The Choose Alerts screen also allows the user to select a Chirping Alert or No Alert for non-priority personal messages. If Chirping Alert or No Alert is selected, the Standard Alert is used for the power-up alert.
International Character Sets	✓	Various languages are supported by re-mapping the ASCII characters to language-specific characters. APPENDIX A provides information about the alphanumeric prompts and special character set. APPENDIX B provides information about the ideographic prompts.

Table 0-3. Ideographic Features		
Paging Feature	**Pager Type**	**Description**
	POCSAG	
Errored Message Character Symbol	✓	If the Errored Data Indication programmable option is selected and the pager receives a message with errored data, the display alternates between the errored data and a checkerboard pattern (▦).

Table 0-4. Optional Memory Features

Paging Feature	**Pager Type**	**Description**
	POCSAG	
Maildrop	✓	Maildrop messages are placed in the slot corresponding to the address number. For example, address number two message goes into the second maildrop slot. Each new maildrop message to a particular address replaces the message (if any) at that address.
	✓	Maildrop messages cannot be locked, alarmed, or placed in the Personal Message Notebook.
	✓	Maildrop messages can be stored in the Maildrop Message Notebook.
	✓	A duplication check is not performed on maildrop messages.
Maildrop History	✓	Stores up to 4 history files for each of one or more maildrop addresses. An existing maildrop message is moved to the address-specific history file when a new maildrop message is received. The oldest history file is deleted if an address has 4 history files when a new message is received.
Retain Better Maildrop Message	✓	Causes a new maildrop message to replace an existing maildrop message only if the new message contains the same number or more good (non-errored) characters than the existing maildrop message.
Enable Maildrop Alert	✓	Displays the Maildrop Alert On icon (♪) or the Maildrop Alert Off icon (♪) on the Function menu when the cursor is placed on a maildrop message. Each maildrop source can be individually set to Maildrop Alert On or Maildrop Alert Off. When Maildrop Alert On is selected, the pager produces an audible chirp or short vibration on receipt of a new maildrop message.

Table 0-4. Optional Memory Features

Paging Feature	Pager Type: POCSAG	Description
Memory Cleanup	✓	Erases all previously read, unprotected personal messages; all read maildrop messages; and all maildrop history files when the Delete All Messages icon ( ) is selected from the Function menu. Any unread or protected messages (locked, alarmed, or personal notebook) are retained in memory.
Duplicate Message Detection	✓	A character-by-character duplication check is performed on messages meeting certain criteria. Errored characters are ignored during the check. If all non-errored characters in two messages match, the messages are duplicated. The message with the fewest errors is kept and the other message is discarded. If both messages contain the same number of errors, the new message is discarded and the old message is flagged as a duplicate. A message flagged as a duplicate is marked as unread, and when read, DUPLICATE MESSAGE is displayed before the first line of the message.
	✓	Checks all personal messages of the same type (numeric, alphanumeric, or ideographic) and source as the incoming message.
	✓	If the Address (Source) Independent option is selected, duplicate checks are performed on messages from different sources.
Sequential Lockout	✓	Allows duplicated messages sent within the specified time-out period to be treated as if only one message was received. Receiving new messages during the sequential lockout period extends the lockout period for both (or all) locked-out messages. Does not apply to maildrop messages.
	✓	Requires the Duplicate Message Detection option be selected. If the sequential lockout period is set to none, a duplicate message is detected immediately.

Table 0-5. Optional Alert Features

Paging Feature	Pager Type: POCSAG	Description
User-Changeable Alert Mode	✓	Allows user-selection of either the audio or vibrate alert mode from the Function menu.
User-Selectable Alerts	✓	Allows user-selection of a standard alert, one of seven pleasing alerts, chirp alert, or no alert (incoming pages only) from the Choose Alert screen.

Table 0-5. Optional Alert Features

Paging Feature	Pager Type: POCSAG	Description
Programmable Pleasing Alert	✓	When this programmable option is set to custom, a menu in the Pager Programming Software is used to create a pleasing alert.
Vibrator	✓	The alert mode can be set to silent so the pager vibrates when a message is received.
Silent Pager Operating Mode	✓	Audible alerts are disabled when the pager is programmed for the Silent Alert option. The User Changeable Alert, User Selectable Alert, and Programmable Pleasing Alert options are automatically disabled when this option is set.
Disable All Alerts	✓	Audible and vibrator alerts are not available when this programmable option is selected. This option overrides all other alert options and does not allow alerts to be changed with the Set Alerts function.
Retain Errored Numeric Message	✓	Allows the pager to alert as normal if errors are detected in a numeric message. Without this option selected, the pager does not alert on errored data and the errored message is not stored.
Manual Alert Reset	✓	If this programmable option is selected and the pager is in audible mode, the user must manually turn off all individual, group, and priority page alerts by pressing any button on the pager. If Chirping Alert is selected from the Choose Alert screen, the pager emits a single chirp. If No Alert is selected from the Set Alerts screen, the received message is indicated in the Message/Status screen without an alert.
Reminder Alert Interval and Time-out	✓	When these programmable options are selected and there are unread messages in memory, the pager generates a chirp or vibration based on the programmed time interval. However, the Reminder Alert stops after the programmed time-out period is reached.
Alert Frequency	✓	The standard alert frequency can be selected when programming the pager with the Pager Programming Software.
Alert Duration	✓	Non-priority personal alerts can be programmed for either 2 seconds or 12 seconds.

Table 0-6. Time Function Options

Paging Feature	Pager Type	Description
	POCSAG	
Private Time	✓	Used to set daily times at which the pager automatically turns on and off. When selected, is displayed in the top left corner of the LCD.
Read and Fast Scroll Time-outs	✓	Causes the pager to display the Message/Status screen when the programmable freeze time period elapses. Pressing and holding the Read button ( ) while reading a message results in a fast scroll. The fast scroll rate is programmable.

Alternate Prompts

The power-up prompt and all source prompts can be customized and alternate prompts can be programmed for the following functions:

- Choose Alert
- Standard Alert
- Pleasing Alert
- Chirping Alert
- Set Audible Alert
- Delete All Messages
- Delete Message
- Escape
- Set Silent Alert
- Turn Pager Off
- No Message Alert
- Add to Notebook
- Print One Message
- Notebook
- Set Message Alarm
- Tone Only
- Lock Message
- Pager Disabled
- Set Private Time
- Memory Full
- Set Time
- Set Alarm
- Set Time and Alarm
- Unlock Message
- Go To Status Screen
- Duplicate Message
- Maildrop Alert On
- Maildrop Alert Off
- Print All Messages
- On
- Off
- Group

The alternate prompts can be in alphanumeric format Alphanumeric prompts and characters are listed in Appendix A.

Table 0-7. Display Options

Paging Feature	Pager Type	Description
	POCSAG	
Auto Backlight	✓	Causes any button press to turn on the display backlighting in low-light environments.
Show Source	✓	Displays source information at the end of a message.
Out-of-Range Indication	✓	Displays the Out-of-Range indicator (, or) on the Message/Status screen when the pager does not detect a synchronization codeword from the paging terminal within the programmed time period. The indicator is displayed until the pager is no longer out of range. If the Out-of-Range Alert option is also selected, the pager alerts when it goes out of range.
Function Menu Display	✓	Selects the type of Function menu display. 1. Ideographic mode: prompts or icons. 2. Alphanumeric mode: prompts, icons, or both.
Auto-Contrast Adjustment	✓	Automatically adjusts the LCD contrast voltage at power-up according to the programmed value.
Errored Data Indication	✓	Causes the pager to display a special non-transmittable error character ( ) to represent an error or bad data. The display alternates between the errored data and a checkerboard pattern ( ).
Zoom	✓	Zoom in:The pager shall display the messae 2 line mode Zoom out:The pager shall display the message 4 line mode
Message Preview	✓	Status screen. The user can scroll left or right to display the first line of adjacent messages.

Table 0-8. Printing Options

Paging Feature	Pager Type	Description
	POCSAG	
Manual Printing	✓	If enabled, messages can be printed by selecting the Print icon while the pager is installed in a mechanical interface connected to a Universal Programming Interface configured for printing.
Data Inversion	✓	If enabled, messages are automatically printed if the pager is installed in a Pager Mechanical Interface connected to a Universal Programming Interface configured for printing.

Table 0-9. RF Options

Paging Feature	Pager Type	Description
	POCSAG	
Data Inversion	✓	High-side or low-side injection is selected with this programmable option.
Signaling Rate Selection	✓	Programmable for a signaling rate of 512, 1200, or 2400 baud.
POCSAG Any Frame	✓	Supports a maximum of 4 pager codes. A code can be located in any frame.
Frequency	✓	The pager's carrier frequency must be programmed to ensure proper radio frequency (RF) performance of the pager.
Receiver IC Type	✓	Set at the factory according to receiver frequency, but can be reset in the field if the receiver type is changed. Refer to the applicable PPS User's Guide listed in the "Related Publications" section to change this setting.

Table 0-10. Over-the-Air Download Options

Paging Feature	Pager Type	Description
	POCSAG	
OTA Programming Disabled	✓	Disables over-the-air (OTA) programming. Pagers with this option set to YES must be programmed using the Pager Mechanical Interface and the Pager Programming Software.
Silent OTA Programming	✓	Disables the audible reset after OTA programming.
Download Security Level	✓	Programming security level is set to none or maximum. When set to maximum, a password is required to program the pager using a Pager Mechanical Interface (a password is always required to program the pager via OTA).
Dead Pager	✓	Disables the pager if the download procedure is attempted incorrectly eight times and requires the microcomputer be replaced. One successful download (with the proper password) before the pager is "dead" resets the download counter.

Operating Instructions

This section provides information about operating the advanced functions of the Unication Alpha Gold pager. Refer to the applicable operating instructions listed in "Specifications" for further information.

Moving a Message into a Message Notebook

Messages can be stored in notebooks. Personal messages can be moved into the Personal Message Notebook and maildrop messages can be moved into the Maildrop Message Notebook.

A message is moved into a notebook by:

1. Selecting the desired message on the Message/Status screen.
2. Pressing the Function (•) button.
3. Scrolling to the icon.
4. Pressing the Function (•) button again.

Setting the Time and Alarm

The time and/or the alarm is changed by:

1. Selecting the Clock icon () in the Function menu. The Set Time /Alarm screen is displayed.
2. When the Set Time/Alarm function is first selected, the Set Time function is active. The active function is indicated by blinking circles at the beginning and the end of the first line and the prompt displayed on the third line (refer to Figure 1-8).

a. When the circles are blinking:
   - Use the Up and Down buttons (▲ and ▼) to toggle between the set time and set alarm functions.
   - Use the Left and Right buttons (◄ and ►) to move across the fields of the active function.

b. When the circles are not blinking:
   - Use the Up and Down buttons (▲ and ▼) to change values within the selected field.
   - Use the Left and Right buttons (◄ and ►) to move across the fields.
   - Pressing and holding the Up or Down button (▲ or ▼) scrolls through the values appropriate to the field.

Figure 1-8. Set Time and Alarm Screen with Set Alarm Function Active

3. When the desired time is displayed, press the Function button (•) to store the new time and date. If the Read button (–) is pressed before the Function button is pressed, the time change is not stored.

Set Alarm

The alarm can be set for a daily alarm (indicated by --/--/-- in the Set Alarm screen) or a one-time-only alarm by modifying the date field to contain a specific date. When the desired alarm time is displayed, the Function button (•) is pressed to store the new alarm time and date. If the Read button (–) is pressed before the Function button is pressed, the alarm time change is not stored.

To activate or deactivate the alarm, the cursor must be positioned on the Alarm icon in the Set Alarm screen. The Up or Down button (▲ or ▼) is used to set the alarm on (🔔) or off (🔕). When the alarm is activated, the icon is displayed on the standby screen (refer to Figure 1-9).

Figure 1-9. Standby Screen with Alarm Annunciator

Using the Private Time Function

1. Select the Private Time (⊡) in the Function menu to display the Set Private Time screen (see Figure 1-10).
2. Use the Left and Right buttons (◄ and ►) to move the cursor left or right through the time fields. Use the Up and Down buttons (▲ and ▼) to modify the individual fields.
   - The first field shows the Private Time icon that indicates the function is set to either On (⊡) or Off (⊐).
   - The second field specifies the time the pager is to turn on, and the third field specifies the time the pager is to turn off.
   - At the end of each time field, 24hr or AM (or PM) is displayed, indicating the time is displayed in either 24-hour or 12-hour clock notation, respectively.

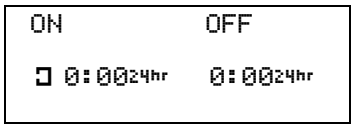


Figure 1-10. Private Time Setting Screen

This function is not enabled if the Private On time is the same as the private Off time.

When the Private Time programmable option is selected and set to On in the Private Time screen, the Private Time icon is displayed in the top left corner of the LCD (refer to Figure 1-11). The Private Time icon is displayed even if the pager is turned off.

Figure 1-11. Standby Screen with Private Time Annunciator

If the programmable Private Time Alert option is selected, the pager chirps or vibrates when the Private Time function turns the pager on or off.

Theory of Operation

The Unication Alpha Gold pager consist of a radio frequency (RF) receiver section and a microcomputer-controlled decoder section. A message is received via an RF carrier that is frequency modulated by a coded binary sequence.

There are two types of receivers available for these pagers: the standard receiver and the Zero Intermediate Frequency (ZIF) receiver. The circuitry in the standard receiver performs the RF-to-IF conversion and the frequency demodulation. The circuitry in the ZIF receiver performs the RF-to-ZIF conversion and the frequency demodulation.

The decoder section processes the coded data using digital techniques, and controls the message memory, LCD, and alert tones depending on the pager model and type of message received. For more information regarding paging code formats, see the “Pager Maintenance Reference Manual.” (Refer to the list of related publications in the Part Numbers section of this manual to obtain the number for this manual.)

Block diagrams are provided to show the typical functions of a:

- Dual Conversion POCSAG pager

None of the diagrams illustrate a pager with a synthesized receiver.

Operating Power

Operating power for both the receiver and decoder boards is obtained from the battery. On the receiver board, a 1-volt regulator supplies the RF circuitry with power.

The decoder board generates 3 volts dc through the linear support module. This voltage is supplied to the microcomputer, linear support module, the character ROM, external RAM, and the display driver integrated circuit (IC). The display driver IC generates an internal 9 volts supply to correctly bias the LCD.

General Circuit Description of Dual Conversion POCSAG Pagers

The following information describes the general theory of operation for the Unication Alpha Gold dual conversion POCSAG pagers. Figure 0-1 displays a typical functional block diagram for a dual conversion POCSAG pager.

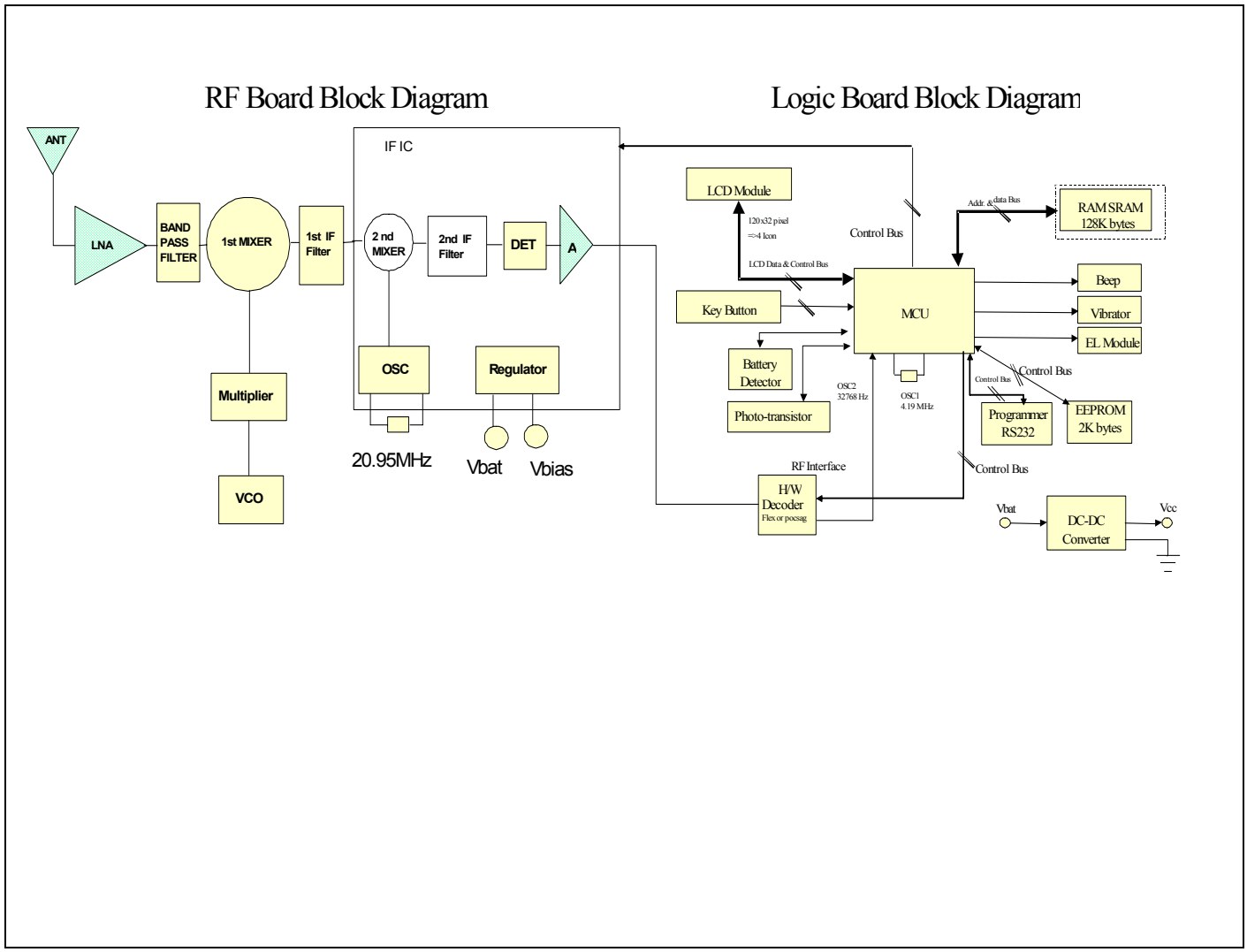


Figure 0-1. Typical Dual Conversion POCSAG Pager

Decoder

The decoder consists of the microcomputer, Display module, external memory

The Microcomputer performs the following:

- Controls the receiver circuits, powering them up and down at the proper time intervals.
- Decodes the binary information received.
- Stores messages in external RAM
- Generates the alert tones and patterns
- Processes user inputs from the keypad
- Controls and writes to the Display module

The Linear Support module performs the following:

- Provides boosted dc voltage to all circuits.
- Monitors battery conditions.
- Drives the lamp, speaker, and vibrator motor.
- Monitors boosted dc voltage.

External Memory

The external memory consists of the following:

- 32k x 8 static performance storage.

The Display module performs the following:

- Provides LCD bias.
- Displays data from the microcomputer.

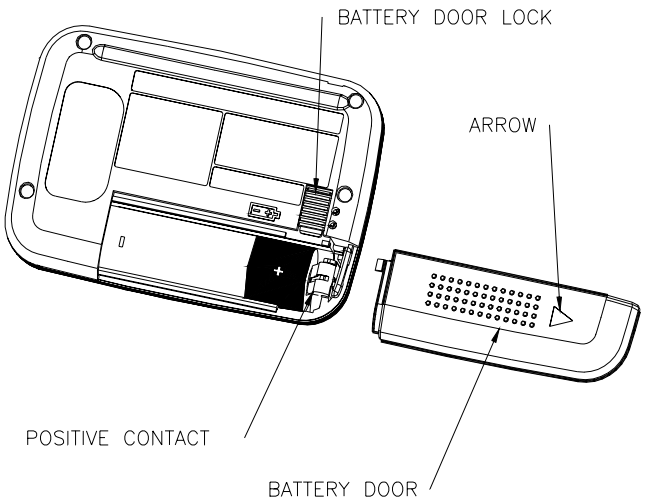
Maintenance

This section provides instructions for the disassembly of Unication Alpha Gold pager. Special tools are listed at the end of this section. An additional list of tools used in maintaining a pager is in the Pager Maintenance Reference Manual (refer to the Related Publications list in the Part Numbers section of this manual for the manual number).

This product contains static-sensitive devices. Use anti-static handling procedures to prevent electrostatic discharge and component damage.

Removing the Battery

1. Ensure the pager is turned off.
2. Locate the ribbed battery-door lock on the back of the pager as shown in Figure below. To unlock the battery door, slide the lock away from the battery door as far as it can go.



3. While pressing on the battery door, slide the door in the direction of the arrow on the door as shown in Figure.
4. Lift the end of the door and remove it completely.
5. Remove the battery by prying the positive end up with a disassembly tool.

Replacing the Battery

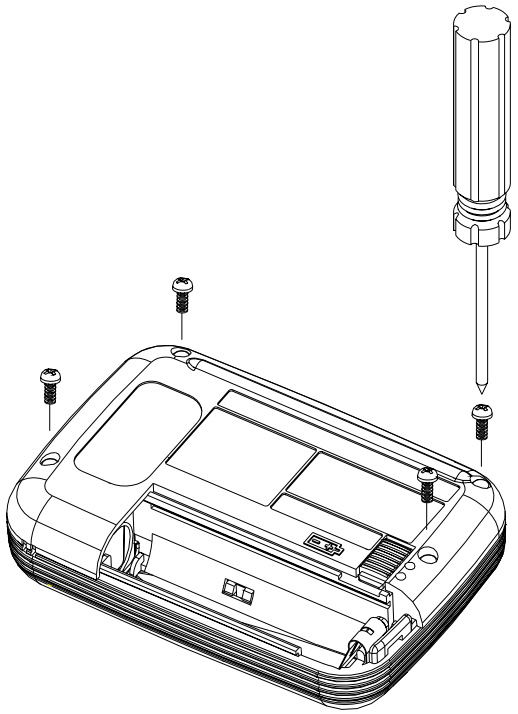
1. Position the new AA-size battery so the "+" and "–" markings on the battery match the polarity diagram in the battery compartment.

Putting the battery in the wrong way (incorrect battery polarity) causes all messages to be erased.

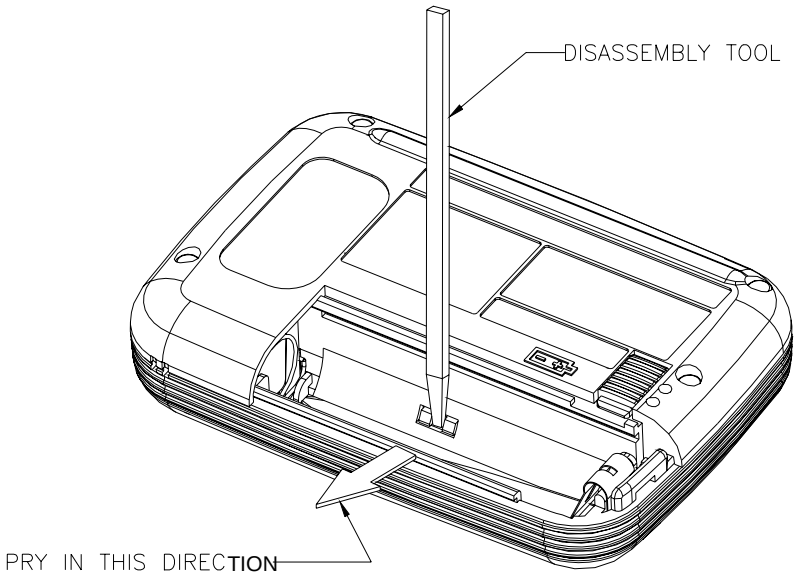
2. Insert the new battery, pressing it against the negative contact until the positive end is seated.
3. Check the battery-door lock and ensure it is in the fully open position.
4. Place the battery door over the battery so the latches on the door are inserted in their respective latch slots.
5. Slide the door closed. (Best results occur with the battery door laying flat on the battery.) An audible click indicates the door is properly seated.
6. Lock the door in place by sliding the ribbed battery-door lock toward the battery door.

Removing the Back Cover

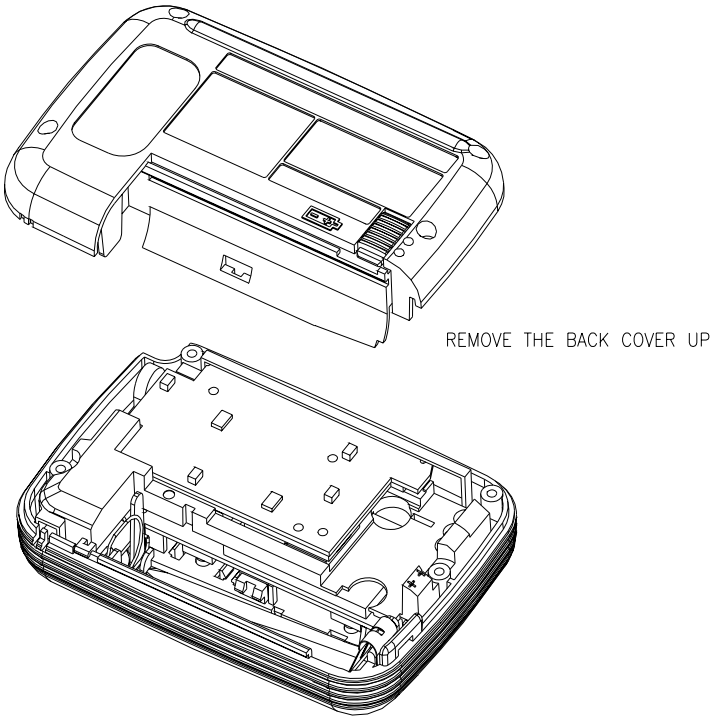
1. Remove the battery door and battery as described in the earlier procedures.
2. Turn the pager so its back is facing up.
3. Remove the 4 screws by using the T6 (star head) screw driver.



4. Use the disassembly tool to disengage the first locking tab in the battery compartment by carefully prying outward (refer to Figure below).



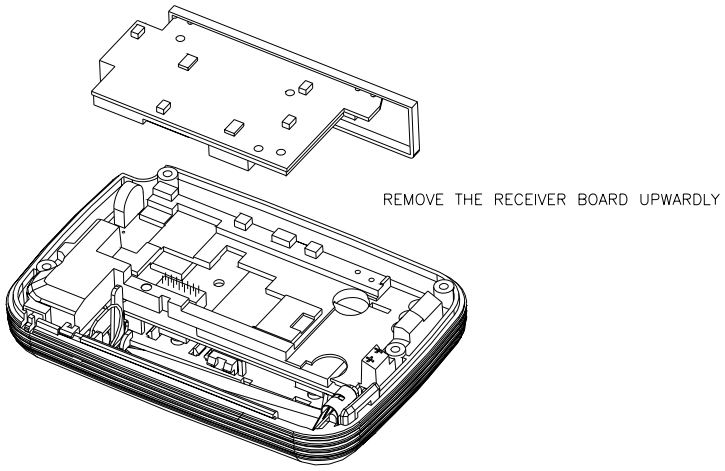
5. After step 4 you can easily remove the back cover.



Removing the Receiver Board

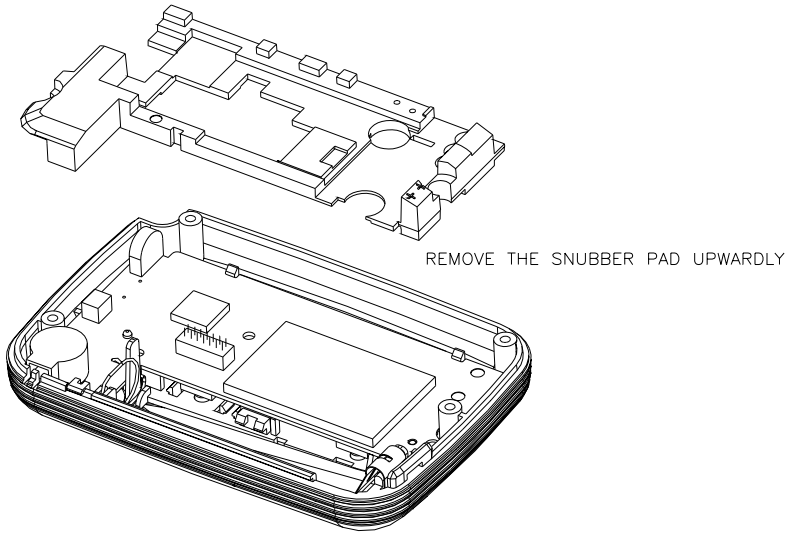
1. Remove the battery door, battery, and back cover as described in the earlier procedures.

2. Hold the decoder board down and gently pry the receiver circuit board up and away from the decoder circuit board at a point near the interconnect socket. When the pins of the interconnect socket are disengaged, the board can be lifted away.



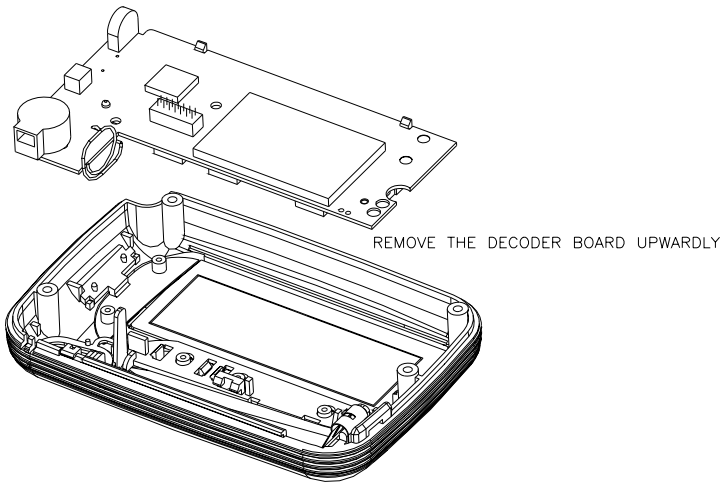
Removing the Snubber Pad

1. Remove the battery door, battery, back cover and receiver board as described in early precedures.
2. Hold the snubber pad and remove it from the decoder board.



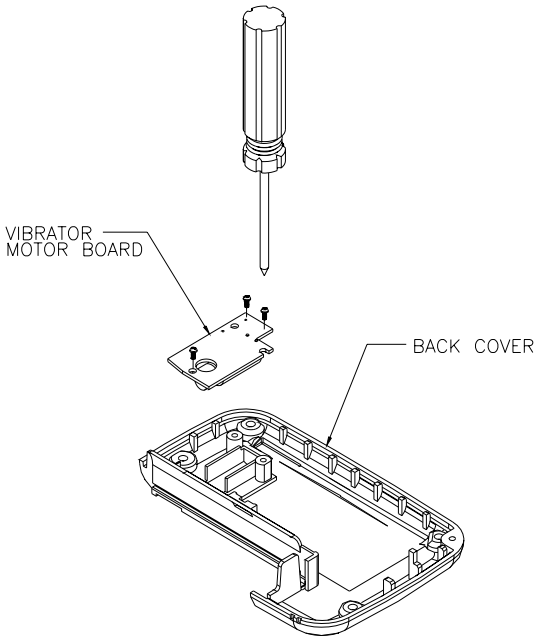
Removing the Decoder Board

1. Remove the battery door, battery, back cover, receiver board and snubber pad as described in the earlier procedures.
2. Hold the decoder board and remove it from the the top cover.



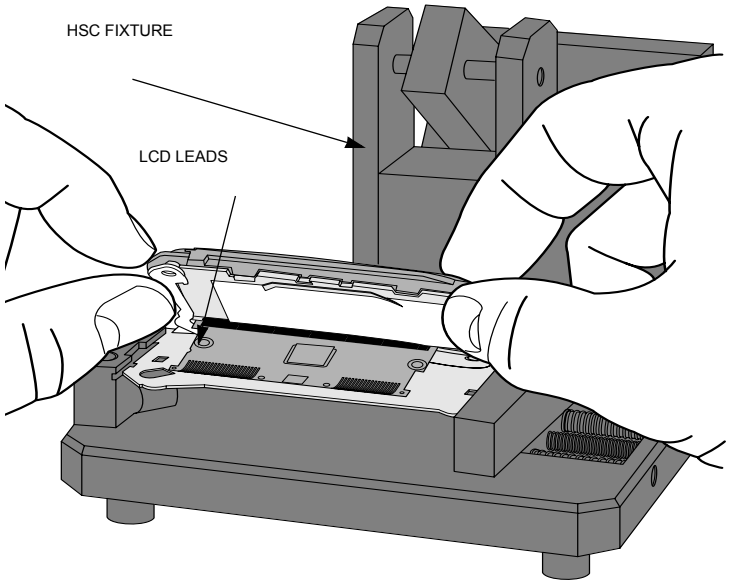
Removing the Vibrator Motor

1. Turn the back cover so the vibrator PCB is facing up.
2. Remove the 3 screws from the vibrator PCB.
3. Hold the vibrator PCB and remove it from the back cover.

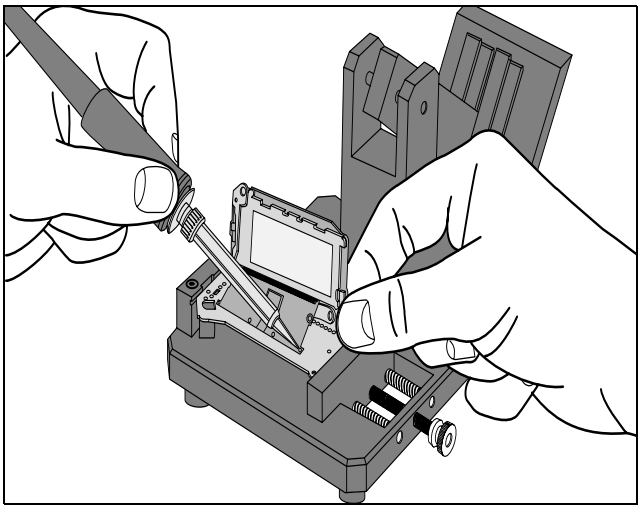


LCD Module Removal

1. Remove the battery, battery door, latch band, back cover, receiver board, shock pad, and decoder board as described in the earlier procedures.
2. Disengage the LCD module light-diffuser catches by using the pointed end of the disassembly tool.
3. Position the Heat Seal Connector (HSC) repair fixture facing you with the pull handle for PCB retention/removal on the right. Place the decoder and LCD module in the fixture (refer to Figure below).



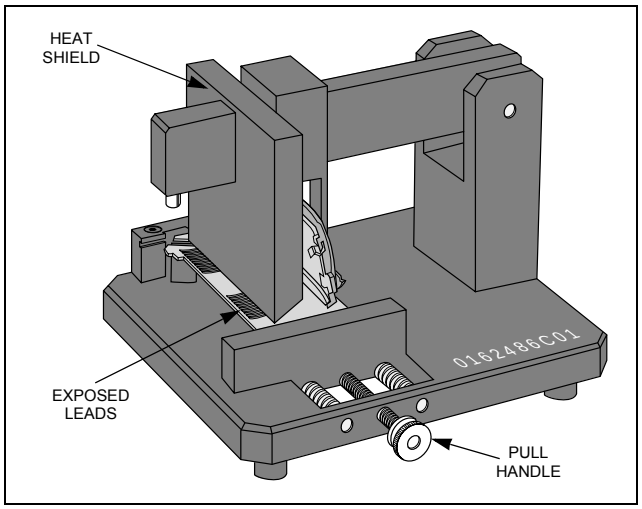
4. Carefully lift the front edge of the LCD module to expose the leads.
5. Apply heat with a soldering iron or hot air machine to the leads across both solder areas until the whole LCD module is detached from the decoder board. Be careful not to overheat and burn the decoder board (refer to Figure below).



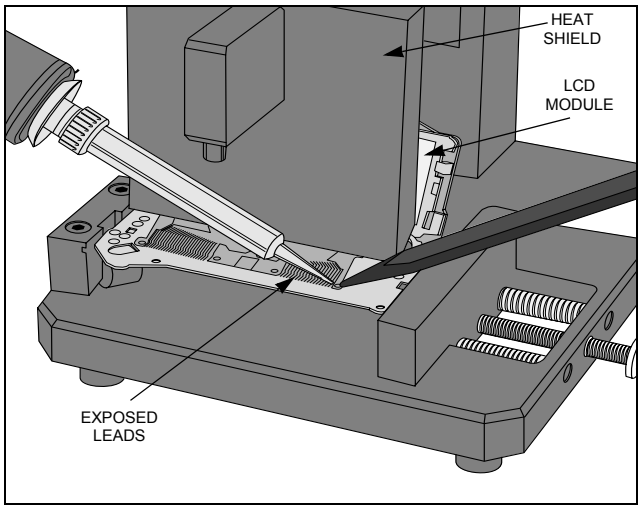
LCD Module Replacement

1. Clean the solder pads with an appropriate cleaner and allow to air dry.
2. Apply a thin, even layer of flux on the solder pads and use a soldering iron to dispense solder on the solder pads (pre-tin). (Ensure there is no bridging of the solder between the pads).
3. Clean the pre-tinned solder pads and allow to air dry.
4. Position the new LCD module on the decoder board with the leads over the pads.

5. Place the LCD module in the fixture (refer to Figure below).



6. Slide the heat shield from left to right and from front to back to expose the leads and pads on the decoder.
7. Align the leads with the pads and tack solder one end of the leads and pads.
8. Start from the unsoldered end of the flex circuit and heat with a soldering iron or hot air machine.
9. Gently push the leads down onto the solder pads using the disassembly tool (refer to Figure below). Use a gentle downward motion onto the decoder and not a sweeping sideways motion, which tends to cause solder bridging between the pads.



10. Clean the solder pads and leads and allow to air dry.
11. Remove the protective paper from the adhesive strip on the light diffuser frame.

12. Connect the module switch pad to the frame locating pin by gently pressing them together.
13. Engage the light diffuser catches with the two slots on the edge of the decoder board.
14. Replace the decoder board, shock pad, receiver board, back cover, latch band, battery, and battery door as described in the earlier procedures.

Troubleshooting

Unication Alpha Gold pager's circuitry is contained in two individual sections. One section is the receiver board, and the other is the decoder board. To disassemble the pager and remove the major assemblies, refer to the Maintenance section of this manual.

Leadless-component technology requires the use of specialized equipment and procedures for repair and servicing of this pager. If you are not sufficiently familiar with leadless-component repair techniques, it is recommended you defer maintenance to qualified service personnel and service shops. Irreparable damage to the pager can result from service by unauthorized personnel. Unauthorized attempts to remove or repair parts can void any existing warranties or extended performance agreements with the manufacturer.

Test Equipment

The following table lists the test equipment unique to Unication Alpha Gold pager. Either the listed items or equivalents are to be used.

Table 1-12. Specific Tools and Test Equipment for Unication Alpha Gold Pager

EQUIPMENT TYPE	APPLICATION
HSC Repair Fixture	Used to hold LCD in place when soldering to decoder.
Alignment back cover	Required for alignment
POCSAG programming kit (584-specific Pager Mechanical Interface, POCSAG Pager Programming Software, and instruction manual)	Required to read and/or program POCSAG pager options
Receiver/decoder interconnect cable	To connect the receiver and decoder circuit boards during troubleshooting
PC programming interface (120 Vac) or PC programming interface (220 Vac)	Interface between the programmer and the PC. Includes interface unit and applicable transformer/cables.

For a list of additional test equipment, refer to the Pager Maintenance Reference Manual (refer to the Related Publications list in the Part Numbers section of this manual for the manual number).

Preliminary Checklist

Use the following table as a quick reference guide to determine the probable cause of some common pager problems and where to find more details.

Table 1-13. Preliminary Troubleshooting Checklist

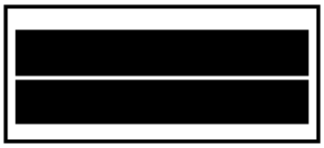
Malfunction	Probable Cause	Details
General pager functions	Check all pager functions using self-diagnostic test and check	General Section - Troubleshooting
Paging Sensitivity	Components are bad	Test Procedures = Pager Maintenance Reference Manual Expected values = Receiver Sections
Pager does not power up	a) Battery voltage low or incorrect polarity b) 4.19 MHzclock not present	Decoder Section
No display or partially active display	a) Broken LCD b) Damaged display contacts	Decoder Section
No page/inactive data port	Poor connection receiver board socket	Receiver Sections
No alerts on power up	Improper or no voltage: requires check of system voltage, clock, reset, and transducer	Decoder Section
Can not page	a) Codeplug and encoder improperly coded b) Decoder and receiver sockets not solder properly at joints	Decoder Section
Buttons do not respond	Switch pad or switch and contacts dirty	Decoder Section
No Backlighting	Low cell	Decoder Section
No vibrator alerts	a) Wires and solder joints not making contact with PCB b) PPS options not programmed	Decoder Section
No audible alerts	Transducer contacts corrupted	Decoder Section
Circuit checks provide wrong readings	Components are bad	Procedure = Pager Maintenance Reference Manual Expected values = Receiver Sections
10 dB rise failure	Pager is improperly aligned. Realign according to procedure	10 dB rise procedure = Pager Maintenance Reference Manual Alignment procedure = Receiver Sections
Improper Gain measurements	Components are bad	Gain measurement procedures = Pager Maintenance Reference Manual Expected values = Receiver Sections

Self-Diagnostic Feature

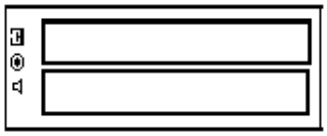
Placing the pager in self-diagnostic mode erases ALL messages from memory.

POCSAG Pagers

1. Ensure the pager is turned off.
2. Press the following sequence of buttons in rapid succession: Left H, Right I, Function K, and Left H.
   a. The LCD displays pager-specific information when first entering the self-diagnostic mode. The first LCD line displays:
      P169xxx - Ryyyy
      xxx represents ITL for international models, and yyyy denotes the software version.
   b. The second LCD line displays:
      POCSAG
      zzzz mm
      zzzz is the baud of the pager and mm is the memory size.
3. Press the Read button (➖) to enter self-diagnostic mode 1 (display test pattern 1). The following is displayed:

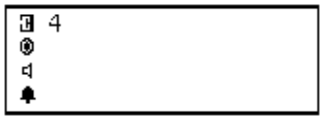


4. Press the Read button (➖) to enter self-diagnostic mode 2 (pixel test pattern 2). The following is displayed:



5. Press the Read button (➖) to enter self-diagnostic mode 3 (audio alert test). The alert sounds and the following is displayed:

6. Press the Read button (➖) to stop the alert.
7. Press the Read button (➖) to enter self-diagnostic mode 4 (vibrator test). The pager vibrates and the following is displayed:



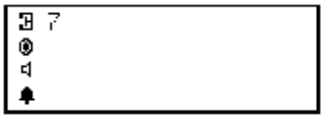
8. Press the Read button (➖) to stop the vibrator.
9. Press the Read button (➖) to enter self-diagnostic mode 5 (receiver on and chirp test). The pager produces an audible chirp and the following is displayed:

10. Press the Read button (➖) to enter self-diagnostic mode 6 (quick page test).

Quick page is used for factory testing purposes. Do not use for troubleshooting purposes.

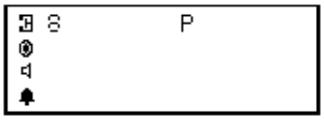
The pager produces an audible chirp and the following is displayed:

11. Press the Read button (➖) to enter self-diagnostic mode 7 (display backlighting test). The display backlighting turns on and the following is displayed:



12. Press the Read button (➖) to enter self-diagnostic mode 8 (RAM test). This mode tests the external RAM and the integrity of the data and address lines connecting the microcomputer to the external RAM. This is accomplished by writing data to the external RAM and reading it back to the microcomputer. If the data read back from the external RAM is the same as that which was written, a P is displayed. If the data is not the same, an F is

displayed. The P or F is displayed on the first line within 10 seconds of entering this test mode. The following is displayed upon successful test completion:



13. Press the Read button (➡) to exit the self-diagnostic mode.

Failure analysis of RF board can be divide into following reasons

- Sensitivity bad
- Center frequency deviation
- Local oscillator fail
- Power circuit abnormal
- No data or wave distortion

Alignment Procedure

Synthesized receivers are tuned to the middle of the bandsplit at the factory for optimal performance across the band. To ensure optimal performance is maintained,execute the tuning download from the PPS to put the pager in the middle of the band. This frequency is called the " tuning frequency" and is different for every band split.

The Unication *Alpha Gold* pager is aligned at the factory to provide peak performance over a long period of time. If alignment is ever required, use the following procedure

1. Turn on the RF circuit: To turn on the RF circuit, short the ***EC*** by soldering a wire to both pads.
2. Ensure a battery with a minimum output of 1.5 volts is installed in the pager.
3. Connect the test equipment.
4. Align the pager according to the alignment procedure described below..

Sensitivity bad

RF board sensitivity bad is the issue which often happened in pager, the issue might be happen with antenna matching, pre-amplifier, filter, Mixer, Oscillator fail. In this section, we discuss sensitivity bad caused by antenna match circuit and pre-amplifier circuit. Following is the simple estimative rule.

Basic Setting:

Put probe of scope on ***TP4***, scope AMPL is set in 10mv/DIV. Set time base in 1us/DIV, adjust signal from load antenna directly, increase or decrease SG output level, let the wave (of trace) on scope around +/- 20mV.

Trouble shooting:

Rotate ***VC1*** by ceramic tooling tool, check TRACE which is shown on scope, if there are two time to reach a pick.

YES: Antenna is norm al, adjust TRACE to the highest, then check next stage.

NO: Check Loop antenna LA which is cold solder or not, check ***VC1*** which is damaged or not, check ***C1***, ***C2***, ***C3***, ***C4*** fail or not.

Center frequency deviation

Center deviation is one of the reason for sensitivity bad, when ***TP20*** is produced,error of receiving frequency is within +/-50Hz (25℃).Because of temperature change, violent vibration when transport or pager is fall down when user careless will cause center frequency of receiver deviation. When ***TP20*** is designed, the issue has been concerned so it can receive frequency normally. When local oscillator frequency +/- 1KHz, sensitivity decrease around 2dB. Frequency deviation means environment temperature is 25℃ , error of frequency is over +/- 50Hz, when in above condition, it should be have trouble shooting.

Basic setting:
Connect probe of scope with frequency counter, put probe on ***TP4***, adjust SG to center frequency and out put signal from normal Load antenna, then increase signal until 450KHz value is shown on frequency counter, indication of GATE on frequency counter will be glitter continuously.

Trouble shooting:
Check frequency counter value which is 450KHz +/-50Hz or not. (When environment temperature is 25℃.

YES: Local oscillator frequency is normal.
NO: Adjust ***VC5***, make frequency counter value is 455KHz +/-50Hz, if it can not be adjusted to 450KHa signal, to check ***X1***, ***C36***, ***C37***, ***VC5***. If any parts fail, please replace it, then adjusted it after temperature turn to normal temperature.

Local oscillator abnormal

There are two reasons for sensitivity bad or 450KHz signal no exist. First is antenna matching circuit, pre-amplifier fail, second is local oscillator abnormal. If bias of antenna matching, pre-amplifier circuit is normal, and no parts is damaged, it might be caused by Local Oscillator abnormal.

Trouble shooting:
Measure voltage of ***TP9*** by Multi-meter, rotate ***VC4*** by ceramic tuning tool to check it can be adjust to DC 1.5V or not.

YES: PLL circuit, LPF circuit (***U2***, ***R20, R21,C33,C32, C31, C38, C39, C40, R16, R17, R10,C41***…etc), VCO circuit (***D1, C20, C21, VC4,C22, C23, Q5, R13, C27, C25, C26, C19, R12, R11, L4***…etc) is normal, check parts of frequency multiplier, as Q6, L6, C29, C30 …etc, replace any fail parts and readjust.
NO: Check 20.95MHz oscillator is normal or not, or check CLK (***PIN11***), PLLD (***PIN12***), LE (***PIN13***) of ***U2*** which input from Decoder is normal or not.

Power circuit is abnormal

Measure the voltage of ***TP3*** by multi-meter, the value should be 1.2 ~ 1.5V, if it is abnormal, to check battery voltage of Decoder board is normal or not. If it is normal, to check power of RF board is short or not.

If battery power is normal, and ***TP2*** ≒ 2.8V， then ***VBB*** ≒ 1V for RF Board regulated power supply.

Bias of transistors is:

Q1 VBE ≒ 0.73V , ***Q2*** VBE ≒ 0.73V , ***Q3*** VBE ≒0.7V

Q6 VBE ≒ 0.73V , ***Q5*** VBE ≒0.7V

No data or wave distortion

When wave is distortion, to check baud rate of filter (***R34***, ***R35***, ***R36***, ***C49***, ***C50***, ***C51***...etc), and replace fail parts.

[redacted]

Unication

DECODER

Contents

Operating Modes 2-1
Power-up Mode 2-1
Page Search Mode 2-1
Page Alert/Display Mode 2-2
Off/Memory Retention Mode 2-3
CircuitDescription 2-3
Power 2-3
Linear Support Module 2-3
Microcomputer Module 2-3
External RAM, Character ROM and Display Modules 2-4
Troubleshooting. 2-5
No Alerts on Power-up. 2-5
Good Power-up Alert, But No Display 2-7
Good Power-up Alert, But Cannot Page 2-8
Buttons Do Not Respond 2-9
No Backlighting 2-9
Messages Lost When Pager Is Turned Off or the Primary Battery Is Removed 2-10
No Vibrator Alerts 2-11
No Audible Alerts 2-11

Operating Modes

There are four basic modes of operation for the Unication Alpha Gold pager decoders: power-up, page search, page alert/display and off/memory retention.

Power-up Mode

Unication Alpha Gold decoders operate in one of two power-up modes, depending on the condition (at or below minimum voltage) of the primary battery.

Primary Battery At or Above Minimum Voltage

A normal power-up occurs in one of two ways: insert a battery with at least 1.24 volts, or press ➖ (Read) after the pager has been turned off.

The linear support module boosts the primary battery voltage to generate the 3. Vdc VCC supply for the decoder, and the microcomputer executes its initialization code. With the peripheral circuits initialized, a power-up alert is issued and the pager proceeds to enter the page search mode. The primary battery voltage must exceed 1.24 Vdc for the pager to power-up in this mode.

Primary Battery Below Minimum Voltage

If a primary battery with a voltage below 1.24 Vdc but greater than 1.00 Vdc is inserted in a pager, the pager powers up and gives a low battery alert. Paging performance with a low battery is poor.

If the primary battery is below 1.00 Vdc, the pager does not power up. It remains in the Off/ Memory Retention mode.

Page Search Mode

Page search is the main operating mode of Alpha Gold pagers. Page search mode operation is divided into battery-saver and data-decoding intervals. The pager software determines when the pager shifts from battery-saver mode to data-decoding mode and back again through the use of one of the microcomputer internal timers.

Page search operation varies the POCSAG pagers as follows:

Battery-saver Interval

POCSAG pagers utilize battery-saver intervals. During battery-saver intervals, the microcomputer generally is in a low-speed, low-power mode and the decoder is operating at a clock frequency pocsag 32768 Hz for approximately 80% of the time (low-speed clock rate).

When the pager is not in a battery-saver interval, the microcomputer internal frequency synthesizer boosts the external crystal frequency of 4.19 MHz

Data-decoding Interval - POCSAG Pager

In the data-decoding mode, the receiver circuitry is powered on by asserting the proper signal levels on port lines PG5, PG4, PG3, and PG2 (***TP16***, ***TP15***, ***TP14***, and ***TP13*** respectively). If a preamble, sync, or address codeword is not detected, the decoder turns off the receiver circuitry and reverts to the battery-saver mode until the next data-decoding interval.

Page Alert/Display Mode

A button press or an incoming message changes the operating mode from page search to page alert/display.

Button Press

If a button is pressed, an interrupt is generated in the microcomputer and the software determines which button was pressed and the correct response. The microcomputer turns on the voltage multiplier that is internal to the LCD module causing the respective LCD pixels pattern to display.

Incoming Message

If the display mode is entered due to an incoming message, the incoming message is stored in the external RAM (***U4***) and the pager generates the required alert pattern output through port line U10 PIN26 to the associated transducer circuitry: ***Q1, R2***, and ***SPEAKER***. If the silent mode is selected, the microcomputer sets port line U10 PIN3 to a logic 0, turning on the vibrator driver.

The microcomputer looks at the message data stored in ***U4*** and retrieves the appropriate character data from either the internal ROM . It then writes the display data to the display module and turns on the display. Certain messages such as the time, date, and function prompts are stored within the microcomputer itself.

Off/Memory Retention Mode

The pager is turned off by selecting the Turn Pager Off option from the Function menu. When the pager is off, the microcomputer disables the display, the receiver circuitry, transducers, A/D converter, and the SCI port used for programming and reverts to the low-speed clock rate.

While the pager is off, the linear support module continues to boost the battery voltage to 3 Vdc, and the pager retains all messages and time/date information in memory. The microcomputer remains inactive until the Read button is pressed, turning the pager on or until the pager is placed in self-diagnostic mode.

When the primary battery is removed, ***U10*** pin 24 toggles low to alert the microcomputer and the microcomputer shuts down all circuitry except the crystal oscillator. The back-up battery (***BAT1***) supplies the operating voltage for the entire decoder.

If the programmable Memory Retention option is set to yes, protection circuitry prevents loss of messages if the primary battery is removed without turning the pager off. However, it is highly recommended the pager be turned off first. If the primary battery is returned within 2 seconds, the pager reverts to the Standby (blank) screen without issuing an alert. If more than 2 seconds elapse without the primary battery, the pager powers up and issues an alert when the primary battery is re-inserted (refer to “Power-up Mode”).

Circuit Description

The decoder consists of the following main functional blocks:

- The linear support module (*U9*)
- The microcomputer module (*U10*)
- The RAM module (*U4*)
- Signal Processor (*U11* in POCSAG only)
- The display module

Refer to “Theory of Operation” in the GENERAL section for a functional block diagram.

Power

Like the receiver, the operating power is obtained from the battery. However, unlike the receiver which has a 1-volt regulator, the decoder uses the power from the battery and generates 3 volts through the Linear Support module. This voltage is supplied to the microcomputer, external RAM, and the display driver IC. The display driver IC generates an internal supply to correctly bias the LCD.

The memory backup battery (*BAT1*) is used to preserve the real-time clock information and the contents of the message memory during primary battery changes. If the backup battery is fully charged, all memory and time data is retained in the pager for at least five minutes after the primary battery is removed. A new primary battery must be installed for at least 24 hours to fully recharge the backup battery. The pager does not power up without a primary battery. The circuitry present in the pager prevents loss of memory provided the pager is off at the time the primary battery is removed.

Linear Support Module

The linear support module (*U9*) generates a boosted dc voltage for the microcomputer, RAMand display. It can terminate the microcomputer operation by generating a reset signal when the operating voltage for the decoder drops below 2.63V. Other circuitry included on the linear support module are:

- A circuit that alerts the microcomputer when the battery is removed or in a low cell state
- A transducer driver, vibrator driver and EL driver
- Backup battery circuitry

Microcomputer Module

The microcomputer (*U10*) controls the overall operation of the decoder.All data transfers to and from the microcomputer are done across the eight-bit data bus. The microcomputer sends data to and retrieves data from the external RAM and sends commands to the display module via this bus.

The functional blocks of the microcomputer are listed below.

POCSAG microcomputer
• Microprocessor
• Microcomputer ROM
• Microcomputer RAM

POCSAG microcomputer

- Analog/Digital (A/D) Converter
- Bit Synchronizer
- Phase Lock Loop Clock Synthesizer
- Two Serial Communications Interfaces (SCI)
- Two Serial Peripheral Interfaces (SPI)
- Keypad Decoder
- I/O lines

The program in microcomputer ROM controls the receiver circuits, powering them up and down at the proper time intervals (microcomputer$_2$ also decodes the receiver audio data). The microcomputer ROM program also decodes the binary information received, stores the received message in external RAM module ***U4***, generates the alert tones, processes user inputs from the keypad, and generates the display screen.

The microcomputer contains a crystal oscillator circuit that operates with an external 4.19 MHz crystal oscillator. This oscillator provides the clock for the microcomputer. However, during data decoding periods or when the display is turned on, the internal frequency synthesizer boosts the external crystal oscillator frequency to the higher frequency required to perform those operations.

One SCI (***U10***) is used by the pager to communicate with the Pager Programming Software when setting or changing software options of the pager.

The A/D converter(***U10***) is used to read an input voltage from the phototransistor circuit to determine when to turn on the display backlighting.

External RAM and Display Modules

The external RAM (***U004***) is either 32k x 8 static random access memory. Message data from the microcomputer is first written to the external RAM when the pager's address is detected and is then read from the external RAM by the microcomputer to display the message.

The display module receives data for display from the microcomputer . The data is stored in the RAM circuitry on the display driver IC prior to its output to the LCD.

The display driver IC has an internal voltage generator that boosts VCC to the appropriate voltage for the LCD glass. It also contains temperature compensation circuitry to maintain an acceptable display contrast over temperature extremes.

Troubleshooting

This section contains the following common conditions requiring troubleshooting of the decoder board:

- No alerts on power-up
- Good power-up alert, no display
- Good power-up alert, but cannot page
- Buttons do not respond
- No backlighting
- Messages lost when pager is turned off
- Messages lost when primary battery is removed
- No vibrator alerts
- No audible alerts

Refer to the trouble shooting charts in the following paragraphs and the diagnostic waveforms on the schematic diagram in the appropriate supplement as a guide to troubleshooting the decoder board.

No Alerts on Power-up

Use the following instructions and Figure 2-1 to troubleshoot this problem.

1. System Voltage Checks – Ensure a battery with a minimum output of 1.3 volts is installed in the pager. Also, ensure good contact is made with the decoder board. VCC must be at least 3 volts.
2. Clock Checks – Check the microcomputer side of resistor ***R7*** for a sinusoidal frequency of 4.19 MHz with an amplitude swing between VCC and ground.
3. Reset Checks – Check pin 1 of ***U6*** to ensure the line remains high (within 100 mV of VCC). This line pulses low periodically if there is a problem with the microcomputer or ***U6***, otherwise it remains high. An oscilloscope is needed to monitor this line. If this line is low, check the voltage at ***U6***, pin 1. If the voltage is high, replace ***U10***; if the voltage is low, replace ***U6***
4. Audible Alerts Check – Check the waveform at the transducer when powering up. If the waveform is okay, replace the transducer. Check for a 3 V peak-to-peak, 3.2 kHz waveform (with standard alert) at the base of ***Q1***. If the correct waveform is present, replace ***Q1***; otherwise, replace ***U10***.

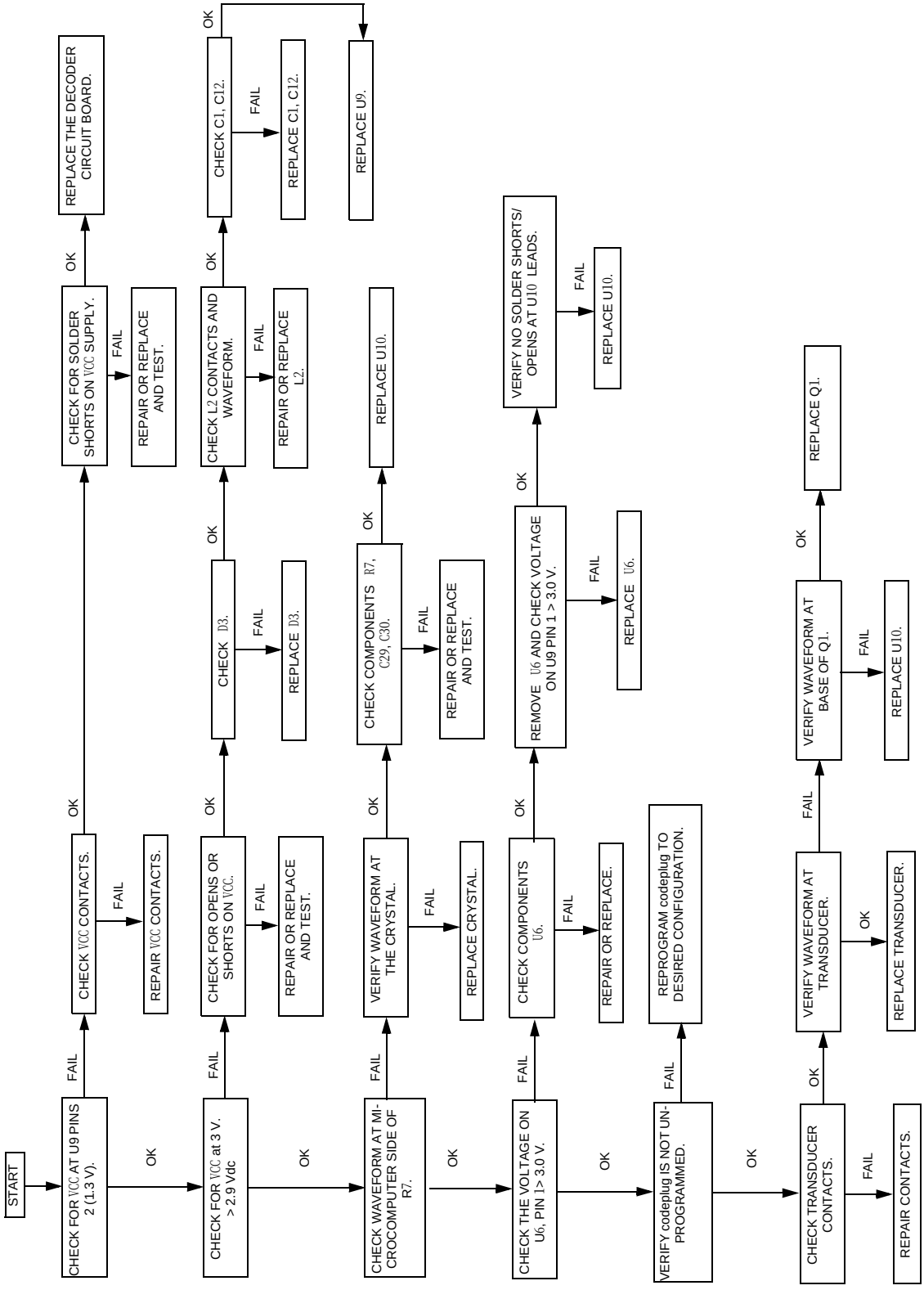


Figure 2-1. No Power-up

Good Power-up Alert, But No Display

Refer to the flowchart in Figure 2-2 and the following instructions to troubleshoot this condition.

1. Verify the codeplug variable, LCD Control, is set correctly to the default value of 15. (The codeplug settings can be read with the Read a Pager function of the Pager Programming Software.)
2. Check the solder connection between the circuit board and the tab connector of the display module.

Use care when inspecting the tab connector. Excessive bending of the tab connector can cause it to peel away from the circuit board and/or break at the circuit board or glass edge joint.

3. With the display turned on, check the following components for the specified square waveforms:
   - ***R16*** Switching waveform from 0 V to 3 V at 31.25 kHz, typical
   - ***C20*** Switching waveform from 3 V to 9 V at 17.30 kHz, typical
   - ***C19*** Switching waveform from 3 V to 8 V at 4.95 kHz, typical
4. Check the voltage across ***C28***. With the display turned on, the voltage should be $\leq$7 and $\leq$ 9 V.

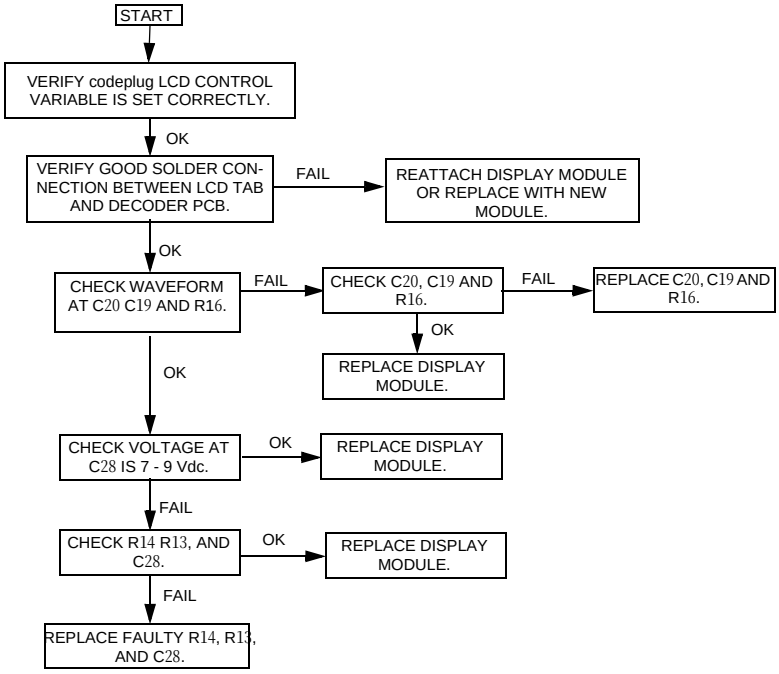


Figure 2-2. Good Power-up Alert But No Display

Good Power-up Alert, But Cannot Page

Refer to the flowchart in Figure 2-3 and the following instructions to troubleshoot this condition.

1. Ensure the codeplug and encoder have proper code and data polarity.
2. Verify the pager's receiver is working correctly by paging it with a known good decoder board.
3. Check the decoder and receiver sockets and their solder joints.

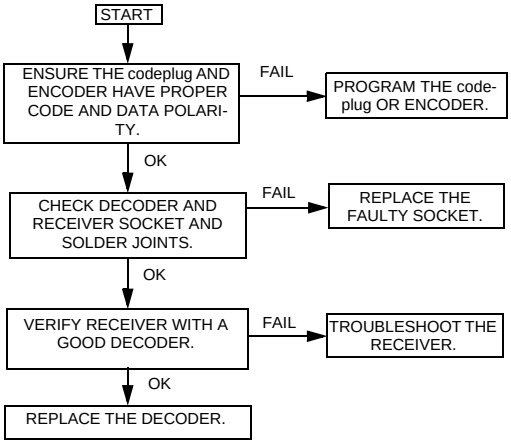


Figure 2-3. Good Power-up Alert But Cannot Page

Buttons Do Not Respond

Refer to the flowchart in Figure 2-4 and the following instructions to troubleshoot this condition.

1. Verify the switch pad is clean and free of debris. Clean it if necessary.
2. Ensure the switch and the circuit contacts are also clean.
3. Test to ensure the corresponding test points (see schematic) drop to 0.1 V when the correct button is pressed.
4. Make sure the switch pad is correctly oriented and not interfering with the pager housing when reassembled.

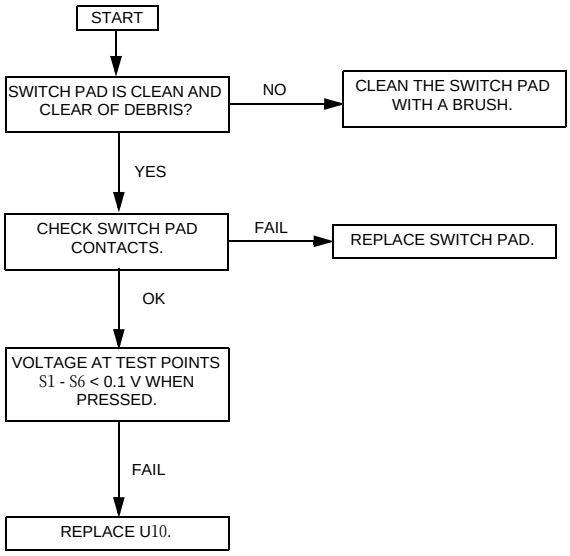


Figure 2-4. Buttons Do Not Respond

No Backlighting

Use the following instructions and the flowchart in Figure 2-5 to troubleshoot this condition.

1. Make sure the low battery indicator is not activated. If it is, change the primary battery. Always ensure a battery with a minimum charge of 1.3 volts is used when testing the backlight feature.

2. Verify the backlighting is activated correctly by pressing the Function button (κ) for more than 1 second, then releasing. .

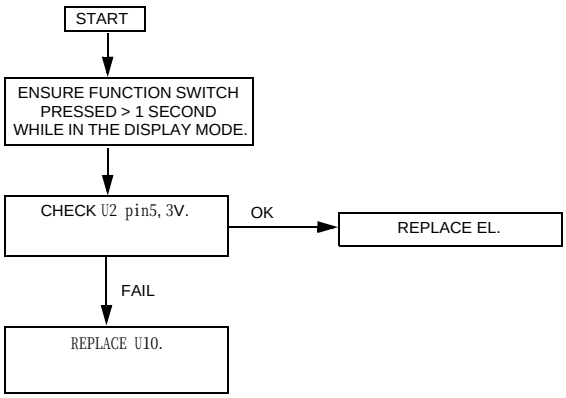


Figure 2-5. No Backlighting

Messages Lost When Pager Is Turned Off or the Primary Battery Is Removed

Refer to the flowchart in Figure 2-6 and the following instructions to troubleshoot this condition.

1. Check the memory options and ensure they provide the desired operation.
2. Check the back-up battery voltage after ensuring a fresh primary battery is installed in the pager for at least 12 hours. The back-up battery must measure at least 2.8 V. If not, replace the back-up battery.

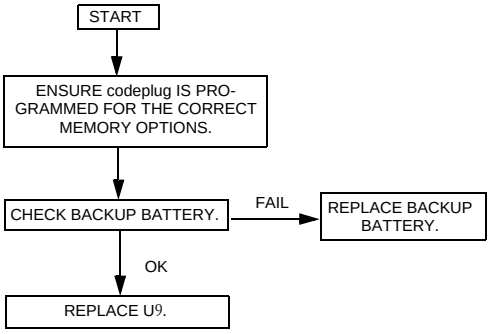


Figure 2-6. Lost Messages

No Vibrator Alerts

Use the following instructions and the flowchart in Figure 2-7 to troubleshoot this condition.

1. Ensure the pager is in silent mode.
2. Activate the Set Alerts screen. Make sure No Alerts is not selected in the Set Alerts screen.
3. Check the options set with the Pager Programming Software to ensure vibrator alerts are enabled and the power-up and alarm alert frequencies are correctly set.
4. Check the springs and the spring contacts to ensure they are in good condition and making contact with the printed circuit board.
5. Verify there is no flux or other residue on either the circuit board or vibrator contacts.
6. Check the operation of the vibrator by placing 1.3 Vdc across the terminals.

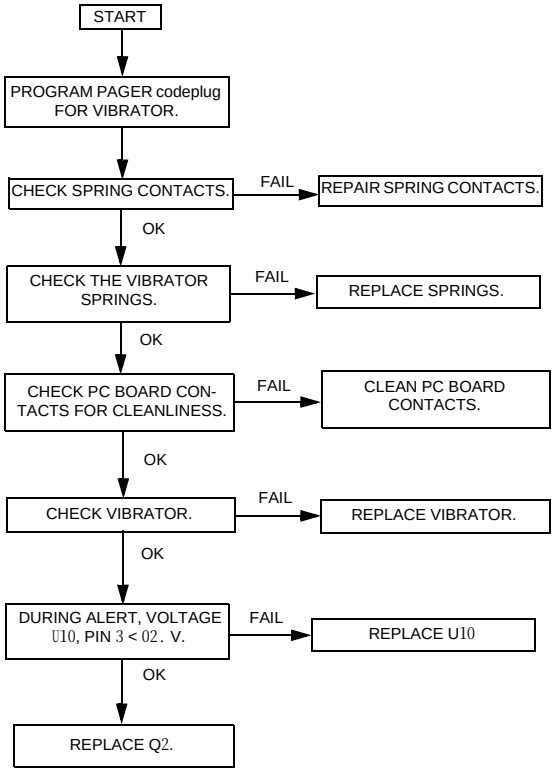


Figure 2-7. No Vibrator Alerts

No Audible Alerts

Use the following instructions and the flowchart in Figure 2-8 to troubleshoot this condition.

1. Verify the pager is in the audio mode and not the silent alert mode (check for the Speaker icon, s).
2. Activate the Set Alerts screen. Make sure No Alerts is not selected in the Set Alerts screen.

3. Check the options set with the PPS to ensure vibrator alerts are enabled and the power-up and alarm alert frequencies are correctly set.
4. Verify the transducer contacts are okay.
5. Monitor the waveform at the transducer with an oscilloscope while alerting. If the waveform is accurate, replace the transducer. If it is not, check for a square wave signal at the base of ***Q1***. If the signal is present, replace ***Q1***; otherwise, replace ***U10***.

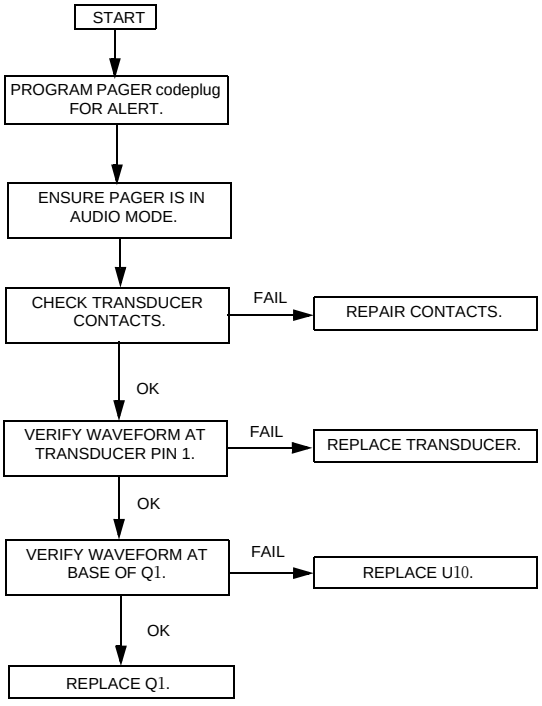


Figure 2-8. No Audible Alerts

[redacted]

VHF RECEIVER

Contents

Specifications 3-1
Circuit Description 3-2
Antenna and RF Amplifier 3-2
Mixer Circuit 3-3
Tuning 3-3
OscillatorFrequencies 3-4

Specifications

AARD406/7X Receivers

Frequency Stability: (-10°C to +50°C with +25°C reference)	15 ppm of reference frequency		
Spurious and Image Rejection:	55 dB below carrier		
EIA Selectivity:	60 dB at ±25 kHz		
	512 Baud	**1200 Baud**	**2400 Baud**
Paging Sensitivity (µV per meter)	5.7	8	10.3
Power Consumption (mA average):	1.00	1.15	1.35
Battery Life: (days at 0.15 pages per hour and full-capacity alkaline battery)	≈ 85	≈ 80	≈ 65
Battery Life: (at 2 pages per day, full-capacity alkaline battery, with a collapse of 4)	Not Applicable		

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE

Circuit Description

The following information describes the circuitry specific to the Unication Product Family *Alpha Gold pager* with a synthesizer receiver board. RF circuit structure of *Alpha Gold* is as RF diagram. RF signal is received by antenna circuit, then get into RF-amplifier circuit which is low noise and high gain, signal is amplified about 20dB, afterwards pass through band pass filter to filter out noise. After that, to mix oscillator signal (L01) which characteristic is excellent, it will filter out noise and send IF1 signal to IF IC, then restore receiving data to connect DECODER circuit.

Antenna Circuit

Alpha Gold uses Loop Antenna, add matching circuit ***L0, C1***, ***C2***, ***C3***, ***C4***, ***VC1, R19, D2*** … etc, it makes amplifier circuit can work in low noise condition, and resonate to receiving frequency.

RF-amplifier & Filter Circuit

• RF-amplifier Circuit：It amplifies signal which is received by antenna circuit on needed strength in best noise figure. RF-amplifier Circuit of *Alpha Gold* uses series connection which composed of ***Q1*** and ***Q2*** to amplify structure. The structure can gain the circuit to the max, and improve sensitivity.
• Filter Circuit：It filter out all signal except carrier, makes receiver to have good sensitivity and image rejection. Circuit components for the part includes bias with R1, R2, C5 and C6, load and filter circuit with ***L1***, ***L2***, ***C9***, ***C8***, ***C7***, ***C7_1***, ***VC2***, ***D4, R18***. ***C11*** will couple RF signal to mixer circuit.

Oscillator Circuit

Feature of *Alpha Gold* receiving circuit is stable and frequency can be changed any time. It uses feedback and temperature compensation circuit which composed of PLL IC (***U2***), low-pass filter circuit, Colpitts oscillators circuit and frequency multiplier circuit to resonate stable oscillator frequency.
• PLL IC (***U2***) Circuit：PLL IC is a integrated circuit which handle frequency compound specially, DECODER board provides data of oscillator frequency to ***PIN11*** (CLK), ***PIN12*** (Data), ***PIN13*** (LE) of PLL IC ,***PIN1*** and ***PIN2*** of PLL IC connect to 20.95 MHz Crystal oscillator (***X1***, ***C36***, ***C37***, ***VC5***) for offering sequence. ***PIN5*** of PLL IC output to low-pass filter which composed of ***C38***, ***R16***, ***C39***, ***R17***, ***C40***, ***C41, R10*** and filter out high frequency noise for offering a stable voltage to VCO Oscillator circuit.
• VCO Oscillator Circuit：The circuit changes D1 capacitance through voltage which provide by LPF, resonate programming frequency. Components are composed of ***D1***, ***C20***, ***C21***, ***VC4***, ***C22***, ***C23***, ***Q5***, ***R13***, ***C27***, ***C25***, ***C26***, ***C19, R12, R11, L4*** provide bias circuit ***C24*** provides a feed back circuit to PLL IC.
• Frequency Multiplier Circuit：Oscillator signal is multiplied by ***Q6***, then take out triple multiplier through ***L6***, ***C29***. It couples to Mixer by ***C30*** which are components of power and bias for offering low noise power.

Mixer Circuit

Mixer is to mix RF signal (Fr) and first local oscillator signal (Flo), and it will bring the first intermediate frequency which is lower frequency (21.4MHz), the circuit composed of ***Q3***, ***C12***, ***R4***, ***L3***, ***C13***, ***R6***, ***R5*** is bias. ***L3***, ***C13*** are Tank circuit. ***Q3*** mixes Fr and Flo, then take out 21.4MHz first intermediate signal (IF1) by ***L3*** and ***C13***. IF1 = Fr – Flo. IF1 signal will couple to Crystal filter by through ***F1***.
IF IC Circuit：IF IC is an integrated circuit for dealing with intermediate frequency only. The function as following.
• Second Local Oscillator(LO2)：Colpitts crystal composed of ***PIN1*** which oscillating frequency is 20.95MHz.
• Mixer：Mixer of the IC is double balance type, the first intermediate signal which is 21.4MHz input through ***PIN20***, after correct circuit by matching, IF1 will output with 450KHz second intermediate frequency, which is produced by local oscillating signal mixer. And it will output through ***PIN3***.
• Limiter：Signal of IF2(450KHz) output from ***PIN3***, it is usually received into ceramic filter for filtering out noise which is out the channel, signal will back to inner IC through ***PIN5***, it is amplified about 100dB and limited the voltage amplitude for dealing with detector.
• Detector：It is composed of quadrature type detector. Discriminator connects ***F3*** to ***PIN8*** in IC and ***R31***. The phase of the modulated FSK signal is shifted.
• Baud Rate Filter：Before data outputs to Decoder, for avoiding interference of noise to cause incorrect message rate too high. Noise of data which is detected should be filter out. Circuit is composed of OP amplifier which is inner IC, and match by ***R34***, ***R35***, ***R36***, ***C49***, ***C50***, ***C51***.It will become a Butterworth low-pass filter. Signal will be input from ***PIN11***, then the internal part amplify to ***PIN12***, take out data signal of NRZ through FSK comparing circuit from ***PIN15***, finaly connect ***PIN3*** of ***J1***.
• Regulating and stabling circuit：For avoiding characteristic abnormal this is caused by changing of RF circuit. ***PIN18*** of IFIC offers 1.0 regulating and stabling power. The power offers *Alpha Gold* bias of the first local oscillator, mixer, PLL circuit and VCO circuit.

Power Saving Circuit

Power saving control is a control signal EC which sent by ***PIN13*** of CONNECTOR ***J1***.Turn it on when it connect to IFIC ***PIN13*** ”H”, RF circuit will start to receive message right away. Turn it off when it is “L”, and RF circuit won’t work. At standby mode, it can save power.

Tuning

Synthesized receivers are tuned to the middle of the bandsplit at the factory for optimal performance across the band. To ensure optimal performance is maintained,execute the tuning download from the PPS to put the pager in the middle of the band. This frequency is called the " tuning frequency" and is different for every band split.

Alignment Procedure

Unication *Alpha Gold* pagers is aligned at the factory to provide peak performance over a long period of time. If alignment is ever required, use the following procedure

1. Turn on the RF circuit: To turn on the RF circuit, short the ***EC*** by soldering a wire to both pads.
2. Ensure a battery with a minimum output of 1.5 volts is installed in the pager.
3. Connect the test equipment.
4. Align the pager according to the alignment procedure described below.

Signal generator setup

Frequency = Center frequency of each band
Amplitude signal output = -30dbm
FM encoder = 4.5KHz deviation

Tuning VCO voltage

Measure voltage of ***TP9*** by Multi-meter, rotate ***VC4*** by ceramic tuning tool to make the voltage measured on TP9 is 1.5V

Tuning center frequency deviation

Connect probe of scope with frequency counter, put probe on ***TP4***, adjust SG to center frequency and out put signal from normal Load antenna, then increase signal until 450KHz value is shown on frequency counter, indication of GATE on frequency counter will be glitter continuously. Adjust ***VC5***, make frequency counter value is 450KHz +/-50Hz.

Tuning RF-amplifier

Connect probe of scope with frequency counter, put probe on ***TP4***, adjust SG to center frequency and out put signal from normal Load antenna, then increase signal until 450KHz value is shown on frequency counter, indication of GATE on frequency counter will be glitter continuously. Adjust ***VC2***, make frequency counter value 450KHz has maximal amplitude.

Tuning Antenna

Connect probe of scope with frequency counter, put probe on ***TP4***, adjust SG to center frequency and out put signal from normal Load antenna, then increase signal until 450KHz value is shown on frequency counter, indication of GATE on frequency counter will be glitter continuously. Adjust ***VC1***, make frequency counter value 450KHz has maximal amplitude.

Oscillator Frequencies - POCSAG Pager

Table 3-1. First and Second Oscillator Frequencies for VHF

CARRIER FREQ. (MHz)	1ST OSC. FREQ. RANGE (MHz)	2ND OSC. FREQ. (MHz)
143.0000-153.0000	60.8-65.8	20.95
153.0000-163.0000	65.8-70.8	20.95
163.0000-174.0000	70.8-76.3	20.95

$f_c = 2f_o + 21.4$ MHz (143.000-174.000 MHz)

[redacted]

UHF RECEIVER

Contents

Specifications 4-1
Circuit Description 4-2
Antenna and RF Amplifier 4-2
Mixer Circuit 4-3
Power Saving Circuit 4-3
Tuning 4-4
OscillatorFrequencies 4-5

Specifications

AARE Receivers

Frequency Stability:	5 ppm of reference frequency from -10°C to +50°C with +25°C reference
Spurious and Image Rejection:	50 dB below carrier
EIA Selectivity:	55 dB at ±25 kHz

	512 Baud	1200 Baud	2400 Baud
Paging Sensitivity µV per meter (typical/maximum)	6	8	10.3
Power Consumption (mA average):	1.00	1.15	1.35
Battery Life: (days at 0.15 pages per hour and full-capacity alkaline battery)	≈ 85	≈ 80	≈ 65

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE

Circuit Description

The following information describes the circuitry specific to the Alpha Gold Product Family *Alpha Gold* pager with a synthesizer receiver board. RF circuit structure of *Alpha Gold* is as RF diagram. RF signal is received by antenna circuit, then get into RF-amplifier circuit which is low noise and high gain, signal is amplified about 20dB, afterwards pass through band pass filter to filter out noise. After that, to mix oscillator signal (L01) which characteristic is excellent, it will filter out noise and send IF1 signal to IF IC, then restore receiving data to connect DECODER circuit.

Antenna Circuit

Alpha Gold uses Loop Antenna, add matching circuit ***L0 L0_1, C1***, ***C2***, ***C3***, ***C4***, ***C1_1, C1_2 VC1, R19, D2*** … etc, it makes amplifier circuit can work in low noise condition, and resonate to receiving frequency.

RF-amplifier & Filter Circuit

• RF-amplifier Circuit：It amplifies signal which is received by antenna circuit on needed strength in best noise figure. RF-amplifier Circuit of *Alpha Gold* uses series connection which composed of ***Q1*** and ***Q2*** to amplify structure. The structure can gain the circuit to the max, and improve sensitivity.
• Filter Circuit：It filter out all signal except carrier, makes receiver to have good sensitivity and image rejection. Circuit components for the part includes bias with R1, R2, C5 and C6, load and filter circuit with ***L1***, ***L2***, ***C9***, ***C8***, ***C7***, ***C7_1***, ***VC2***, ***D4, R18***. ***C11*** will couple RF signal to mixer circuit.

Oscillator Circuit

Feature of *Alpha Gold* receiving circuit is stable and frequency can be changed any time. It uses feedback and temperature compensation circuit which composed of PLL IC (***U2***), low-pass filter circuit, Colpitts oscillators circuit and frequency multiplier circuit to resonate stable oscillator frequency.
• PLL IC (***U2***) Circuit：PLL IC is a integrated circuit which handle frequency compound specially, DECODER board provides data of oscillator frequency to ***PIN11*** (CLK), ***PIN12*** (Data), ***PIN13*** (LE) of PLL IC ,***PIN1*** and ***PIN2*** of PLL IC connect to 20.95 MHz Crystal oscillator (***X1***, ***C36***, ***C37***, ***VC5***) for offering sequence. ***PIN5*** of PLL IC output to low-pass filter which composed of ***C38***, ***R16***, ***C39***, ***R17***, ***C40***, ***C41, R10*** and filter out high frequency noise for offering a stable voltage to VCO Oscillator circuit.
• VCO Oscillator Circuit：The circuit changes D1 capacitance through voltage which provide by LPF, resonate programming frequency. Components are composed of ***D1***, ***C20***, ***C21***, ***VC4***, ***C22***, ***C23***, ***Q5***, ***R13***, ***C27***, ***C25***, ***C26***, ***C19, R12, R11, L4*** provide bias circuit ***C24*** provides a feed back circuit to PLL IC.
• Frequency Multiplier Circuit：Oscillator signal is multiplied by ***Q6***, then take out triple multiplier through ***L6***, ***C29***. It couples to Mixer by ***C30*** which are components of power and bias for offering low noise power.

Mixer Circuit

Mixer is to mix RF signal (Fr) and first local oscillator signal (Flo), and it will bring the first intermediate frequency which is lower frequency (21.4MHz), the circuit composed of ***Q3***, ***C12***, ***R4***, ***L3***, ***C13***, ***R6***, ***R5*** is bias. ***L3***, ***C13*** are Tank circuit. ***Q3*** mixes Fr and Flo, then take out 21.4MHz first intermediate signal (IF1) by ***L3*** and ***C13***. IF1 = Fr – Flo. IF1 signal will couple to Crystal filter by through ***F1***.
IF IC Circuit：IF IC is an integrated circuit for dealing with intermediate frequency only. The function as following.
• Second Local Oscillator(LO2)：Colpitts crystal composed of ***PIN1*** which oscillating frequency is 20.95MHz.
• Mixer：Mixer of the IC is double balance type, the first intermediate signal which is 21.4MHz input through ***PIN20***, after correct circuit by matching, IF1 will output with 450KHz second intermediate frequency, which is produced by local oscillating signal mixer. And it will output through ***PIN3***.
• Limiter：Signal of IF2(450KHz) output from ***PIN3***, it is usually received into ceramic filter for filtering out noise which is out the channel, signal will back to inner IC through ***PIN5***, it is amplified about 100dB and limited the voltage amplitude for dealing with detector.
• Detector：It is composed of quadrature type detector. Discriminator connects ***F3*** to ***PIN8*** in IC and ***R31***. The phase of the modulated FSK signal is shifted.
• Baud Rate Filter：Before data outputs to Decoder, for avoiding interference of noise to cause incorrect message rate too high. Noise of data which is detected should be filter out. Circuit is composed of OP amplifier which is inner IC, and match by ***R34***, ***R35***, ***R36***, ***C49***, ***C50***, ***C51***.It will become a Butterworth low-pass filter. Signal will be input from ***PIN11***, then the internal part amplify to ***PIN12***, take out data signal of NRZ through FSK comparing circuit from ***PIN15***, finaly connect ***PIN3*** of ***J1***.
• Regulating and stabling circuit：For avoiding characteristic abnormal this is caused by changing of RF circuit. ***PIN18*** of IFIC offers 1.0 regulating and stabling power. The power offers *Alpha Gold* bias of the first local oscillator, mixer, PLL circuit and VCO circuit.

Power Saving Circuit

Power saving control is a control signal EC which sent by ***PIN13*** of CONNECTOR ***J1***.Turn it on when it connect to IFIC ***PIN13*** ”H”, RF circuit will start to receive message right away. Turn it off when it is “L”, and RF circuit won’t work. At standby mode, it can save power.

Tuning

Synthesized receivers are tuned to the middle of the bandsplit at the factory for optimal performance across the band. To ensure optimal performance is maintained,execute the tuning download from the PPS to put the pager in the middle of the band. This frequency is called the " tuning frequency" and is different for every band split.

Alignment Procedure

The Alpha Gold pagers is aligned at the factory to provide peak performance over a long period of time. If alignment is ever required, use the following procedure

1. Turn on the RF circuit: To turn on the RF circuit, short the ***EC*** by soldering a wire to both pads.
2. Ensure a battery with a minimum output of 1.5 volts is installed in the pager.
3. Connect the test equipment.
4. Align the pager according to the alignment procedure described below.

Signal generator setup

Frequency = Center frequency of each band
Amplitude signal output = -30dbm
FM encoder = 4.5KHz deviation

Tuning VCO voltage

Measure voltage of ***TP9*** by Multi-meter, rotate ***VC4*** by ceramic tuning tool to make the voltage measured on TP9 is 1.5V

Tuning center frequency deviation

Connect probe of scope with frequency counter, put probe on ***TP4***, adjust SG to center frequency and out put signal from normal Load antenna, then increase signal until 450KHz value is shown on frequency counter, indication of GATE on frequency counter will be glitter continuously. Adjust ***VC5***, make frequency counter value is 450KHz +/-50Hz.

Tuning RF-amplifier

Connect probe of scope with frequency counter, put probe on ***TP4***, adjust SG to center frequency and out put signal from normal Load antenna, then increase signal until 450KHz value is shown on frequency counter, indication of GATE on frequency counter will be glitter continuously. Adjust ***VC2***, make frequency counter value 450KHz has maximal amplitude.

Tuning Antenna

Connect probe of scope with frequency counter, put probe on ***TP4***, adjust SG to center frequency and out put signal from normal Load antenna, then increase signal until 450KHz value is shown on frequency counter, indication of GATE on frequency counter will be glitter continuously. Adjust ***VC1***, make frequency counter value 450KHz has maximal amplitude.

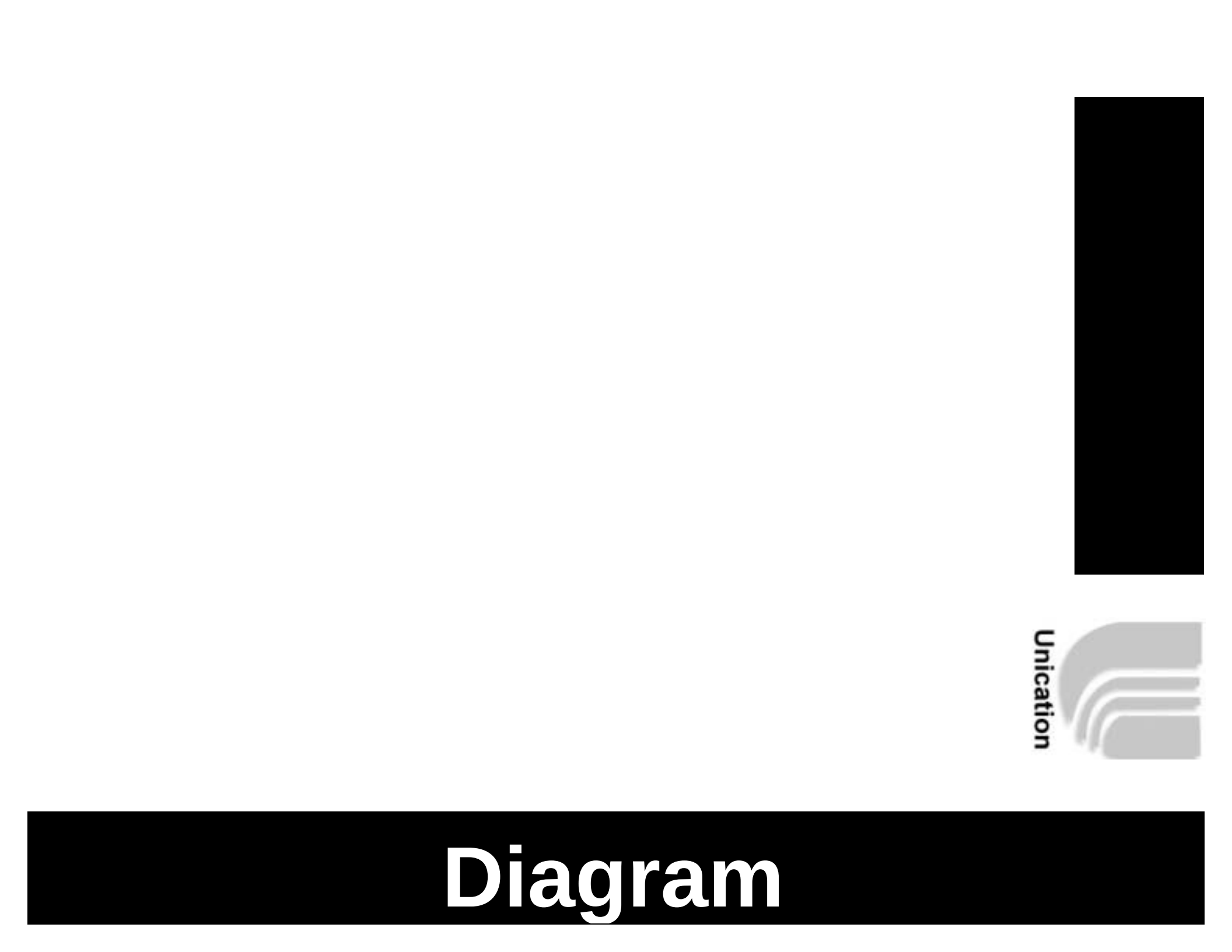
Oscillator Frequencies

Table 8-1. First and Second Oscillator Frequencies for UHF

CARRIER FREQ. (MHz)	1ST OSC. FREQ. RANGE (MHz)	2ND OSC. FREQ. (MHz)
450.0000-460.0000	107.15-109.65	20.95
460.0000-470.0000	109.65-112.15	20.95

Frequencies not listed use 44.545 MHz for 2nd oscillator

$$f_c = 4f_o + 21.4 \text{ MHz (450–470 MHz)}$$



Diagram

Contents

PCB Diagram. 5-1
Receiver Board PCB Diagram (VHF). 5-1
Receiver Board PCB Diagram (UHF). 5-1
Decoder Board PCB Diagram. 5-9
Schematic Diagram 5-16
Receiver Board Schematic Diagram (UHF) 5-16
Receiver Board Schematic Diagram (VHF) 5-17
Decoder Board Schematic Diagram (UHF) 5-18

Alpha Gold VHF Receiver Board V1.4 PCB diagram

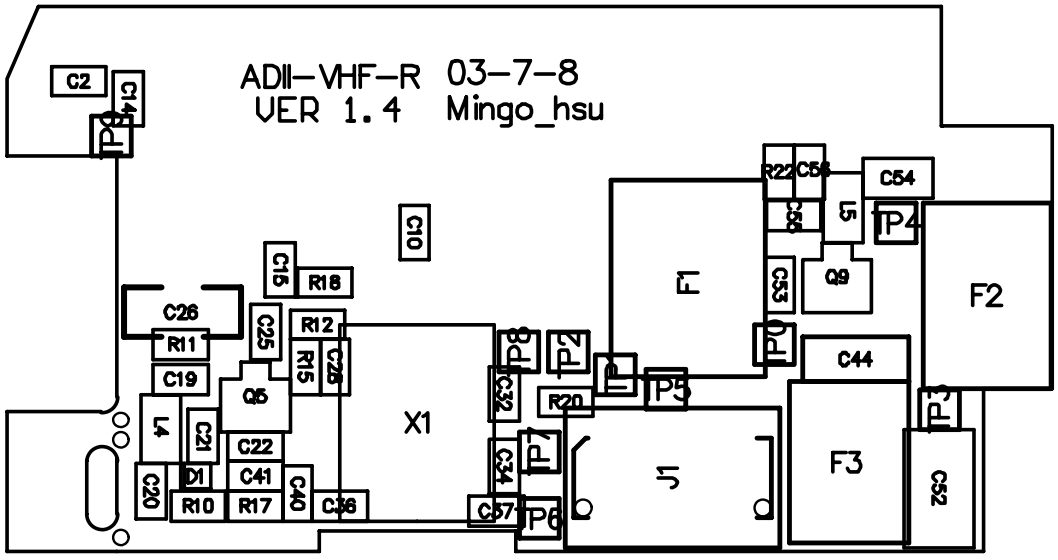


Figure 5-1 Receiver Board TOPOVERLAY

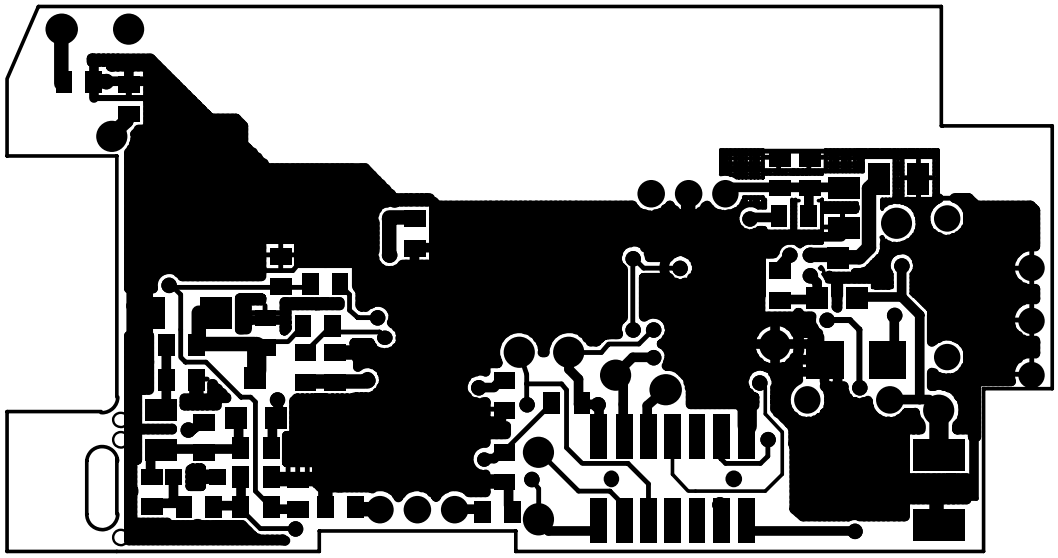


Figure 5-2 Receiver Board TOPOVERLAY

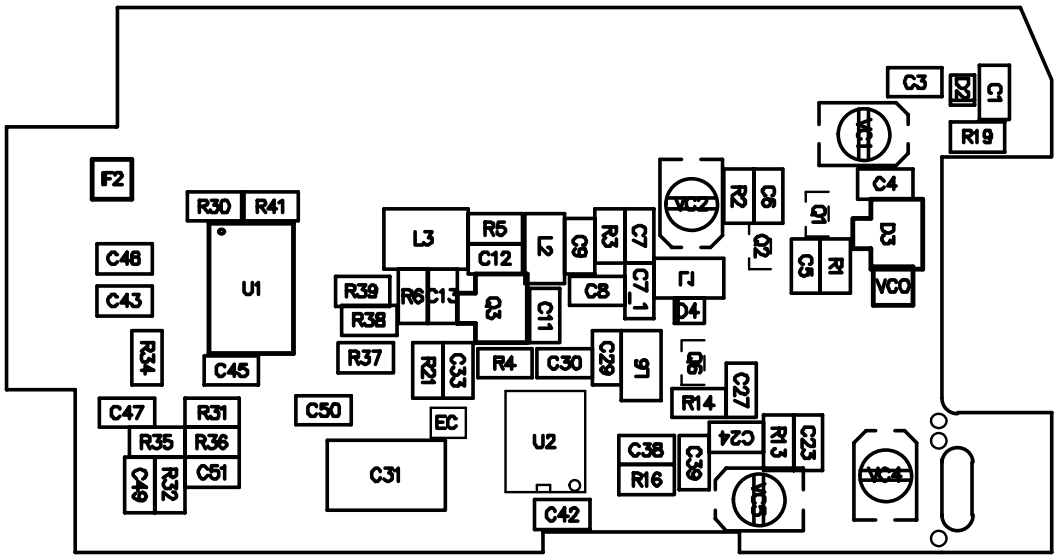


Figure 5-3 Receiver Board BOTTOMOVERLAY

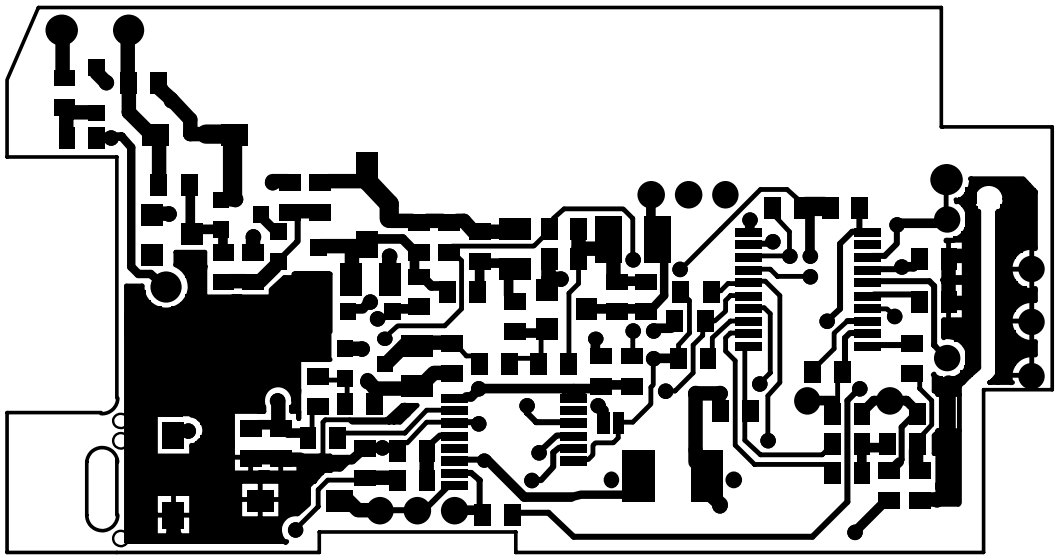


Figure 5-4 Receiver Board BOTTOMOVERLAY

Alpha Gold UHF Receiver Board V1.6 PCB diagram

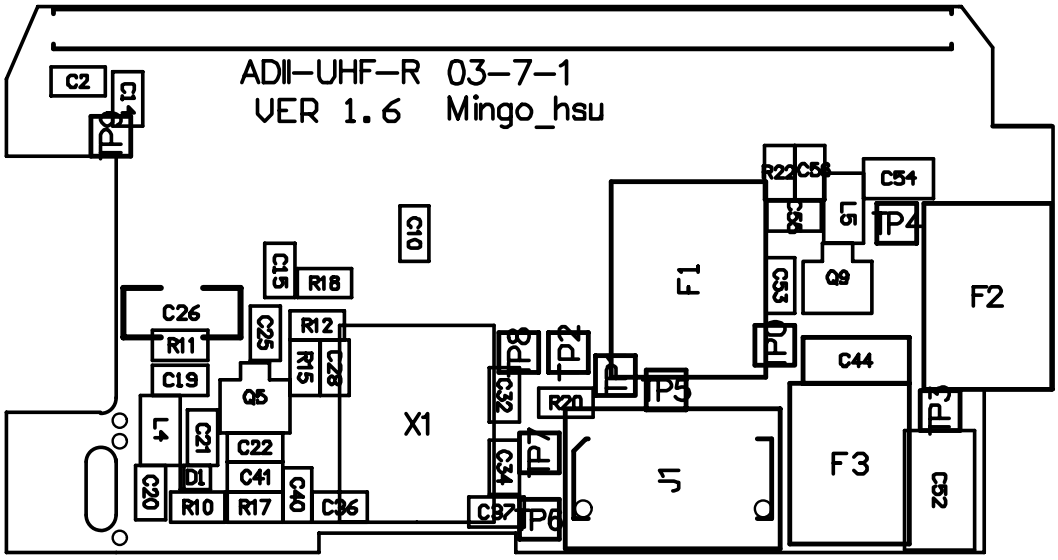


Figure 5-51 Receiver Board TOPOVERLAY

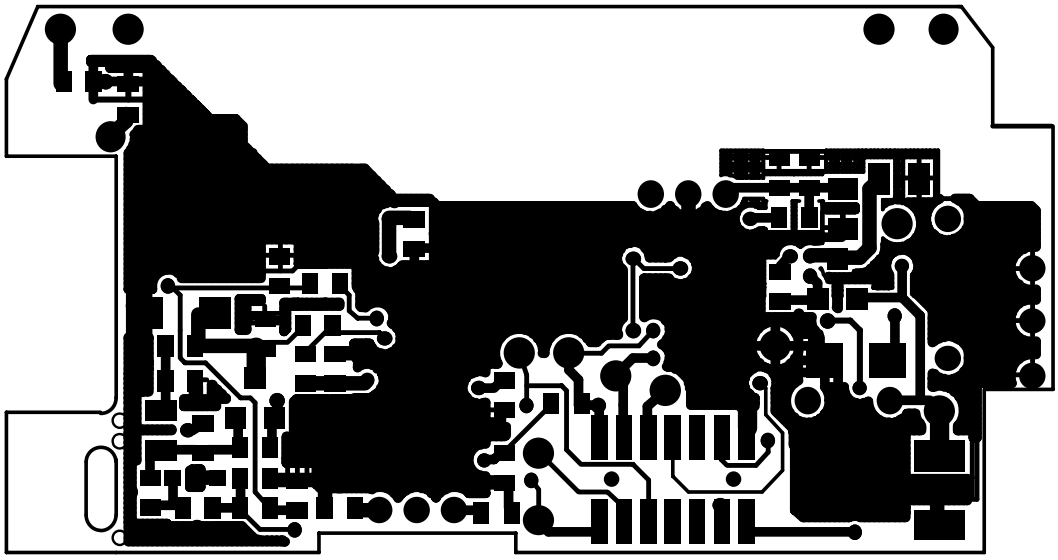


Figure 5-6 Receiver Board TOPOVERLAY

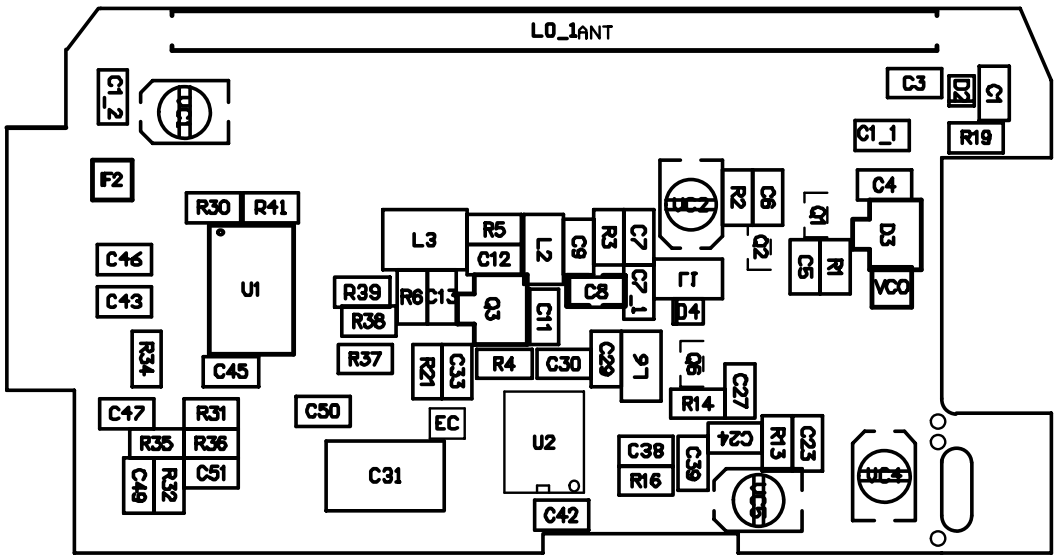


Figure 5-7 Receiver Board BOTTOMOVERLAY

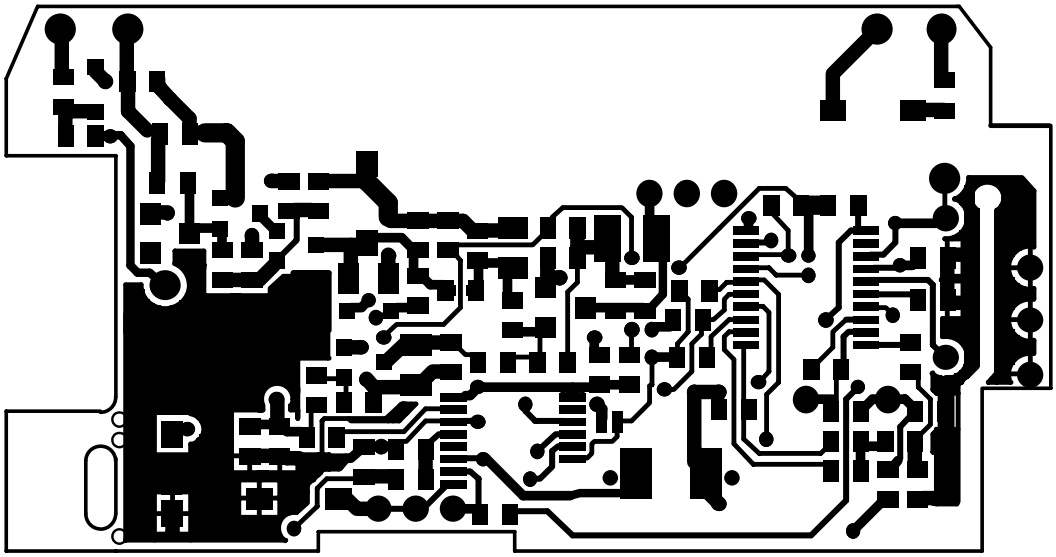


Figure 5-8 Receiver Board BOTTOMOVERLAY

VHF Decoder Board PCB Diagram

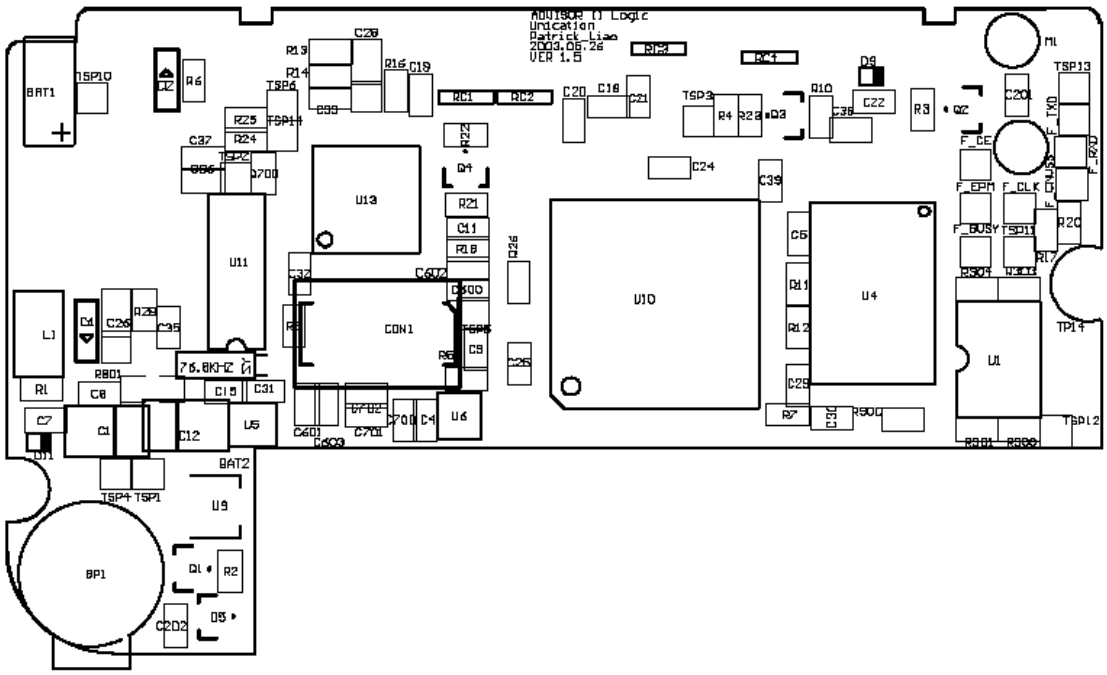


Figure 5-9 Decoder Board TOPOVERLAY

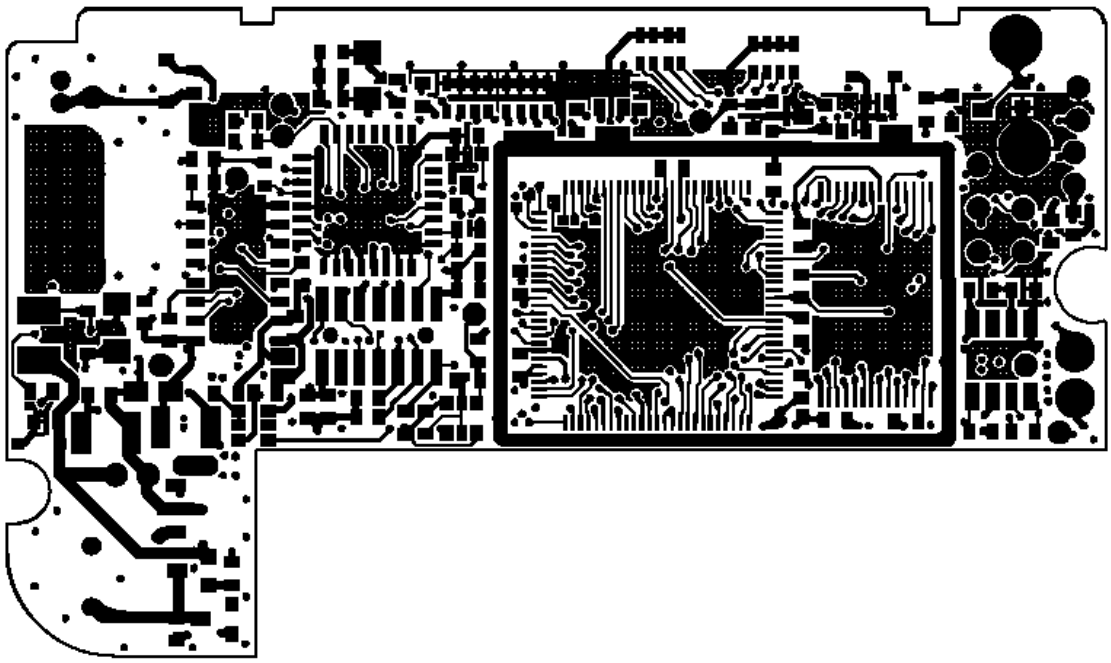


Figure 5-10 Decoder Board TOPOVERLAY

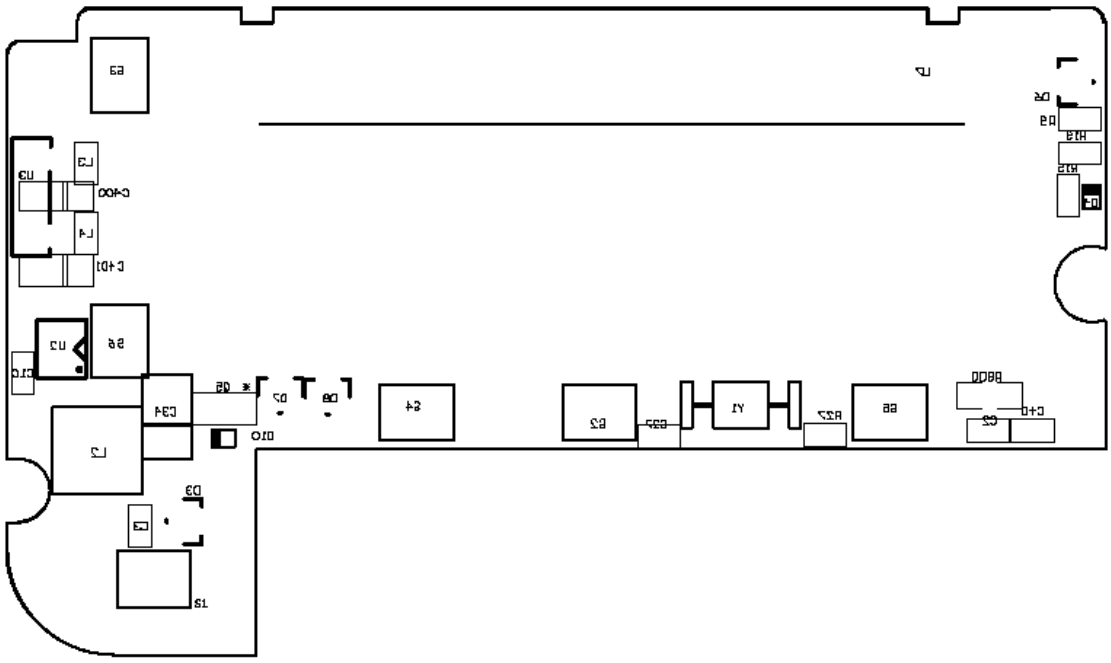


Figure 5-11 Decoder Board BOTTOMOVERLAY

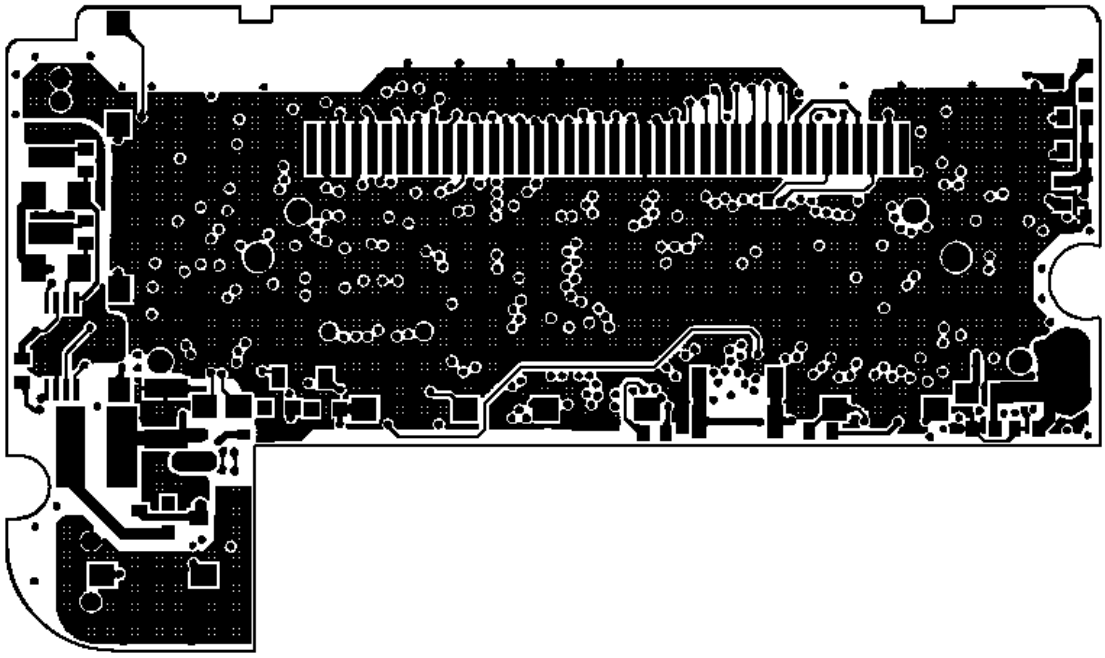


Figure 5-12 Decoder Board BOTTOMOVERLAY

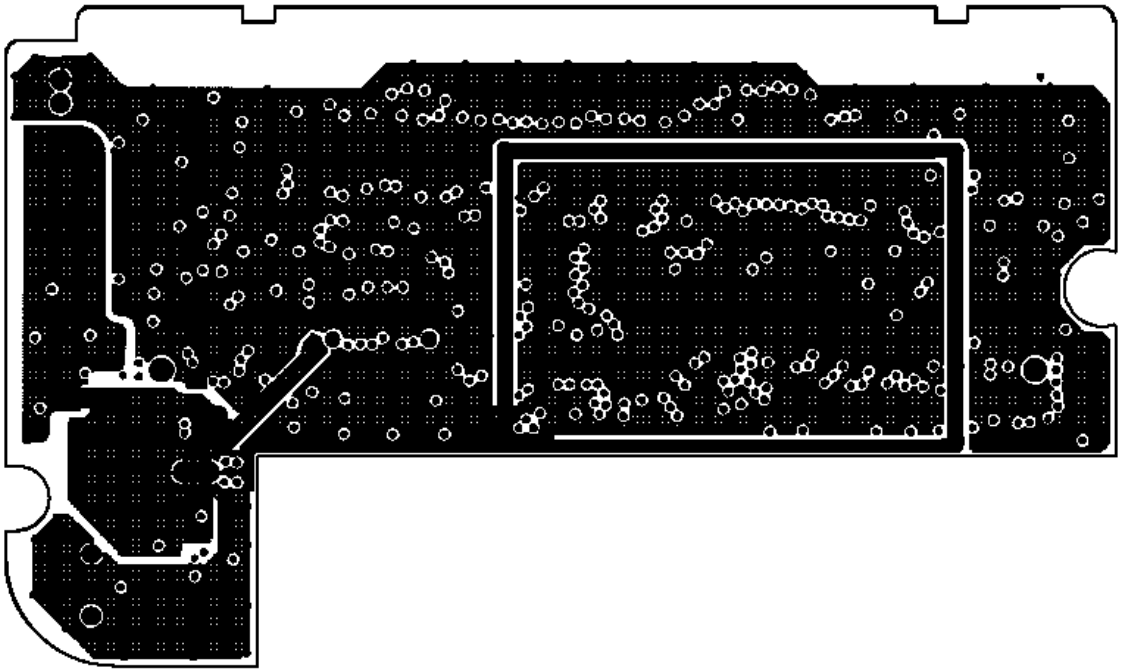


Figure 5-13 Decoder Board GNDLAYER

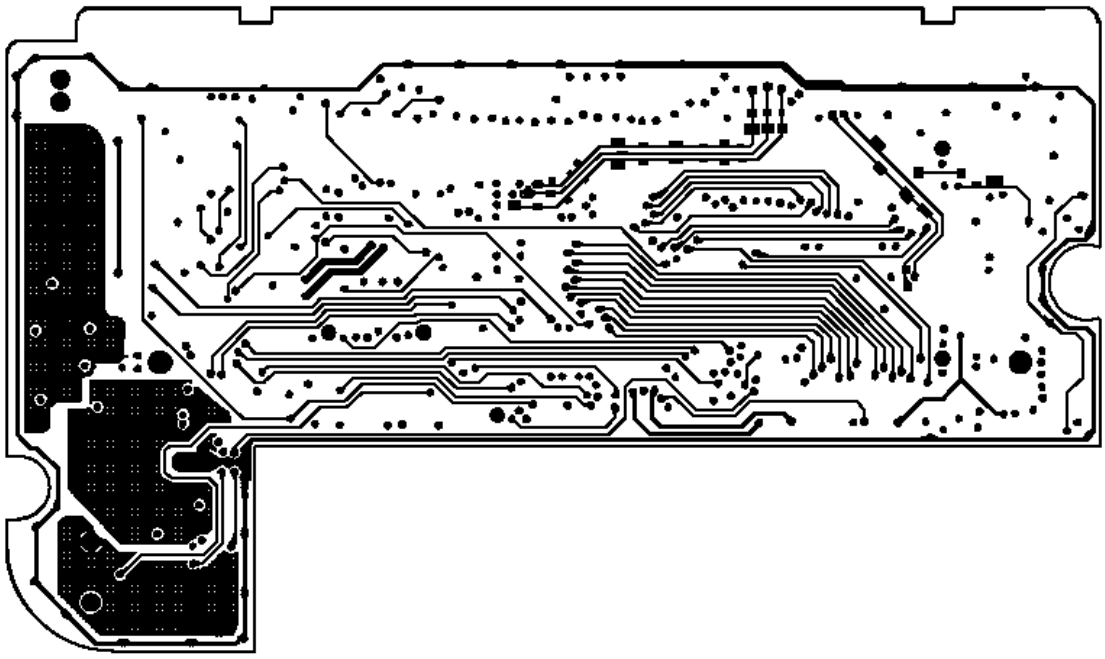


Figure 5-14 Decoder Board HILAYER

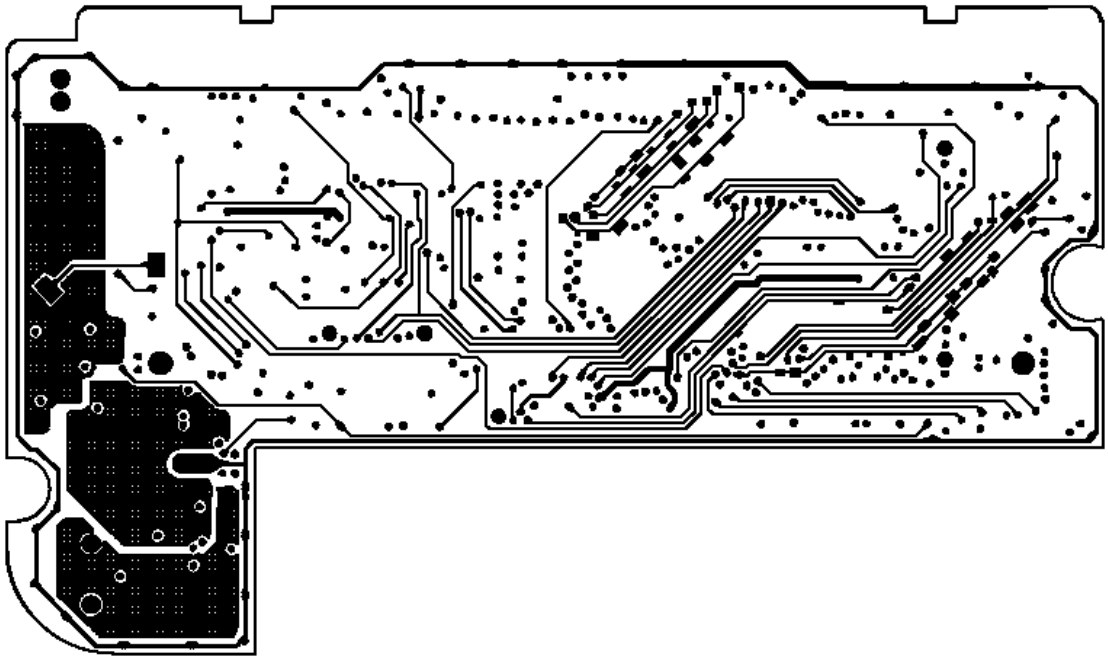


Figure 5-15 Decoder Board LOWLAYER

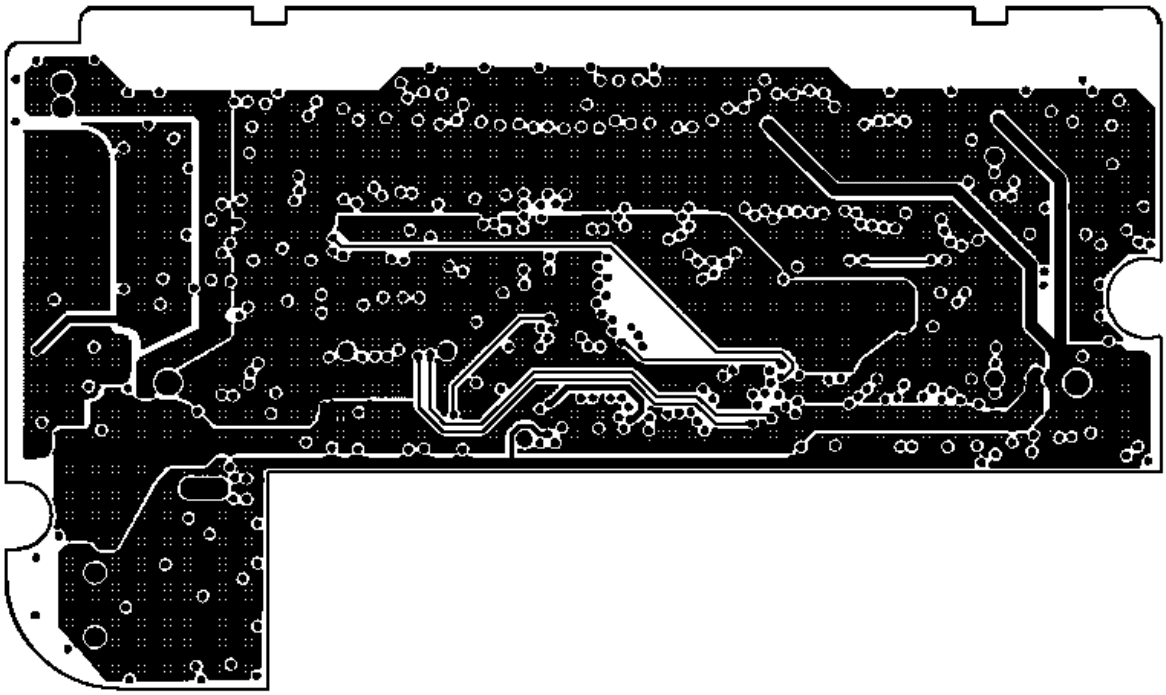


Figure 5-16 Decoder Board POWERLAYER

Receiver board VHF Schematic Diagram

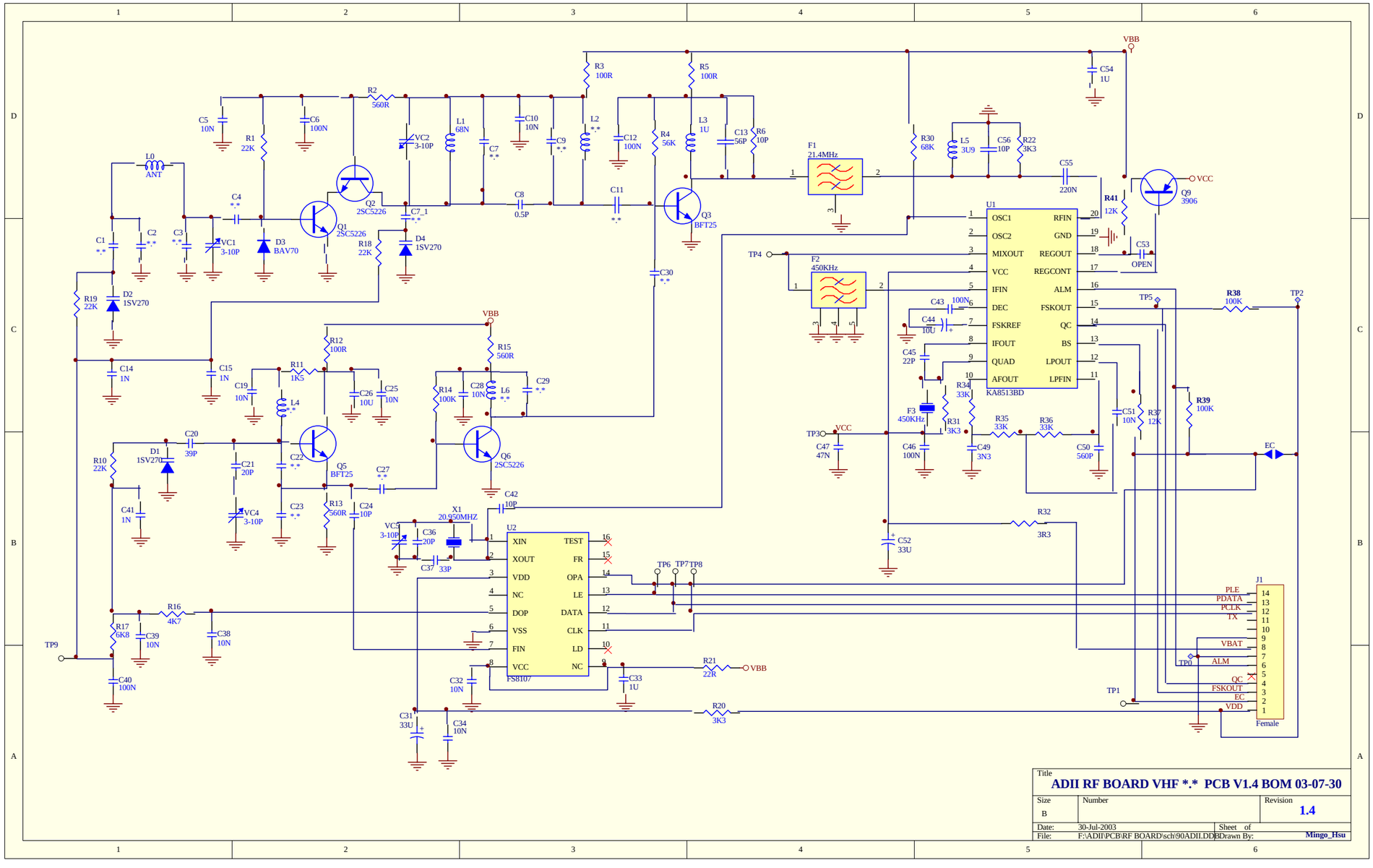


Figure 5-17 Alpha Gold VHF Receiver Board Schematic Diagram

Receiver board UHF Schematic Diagram

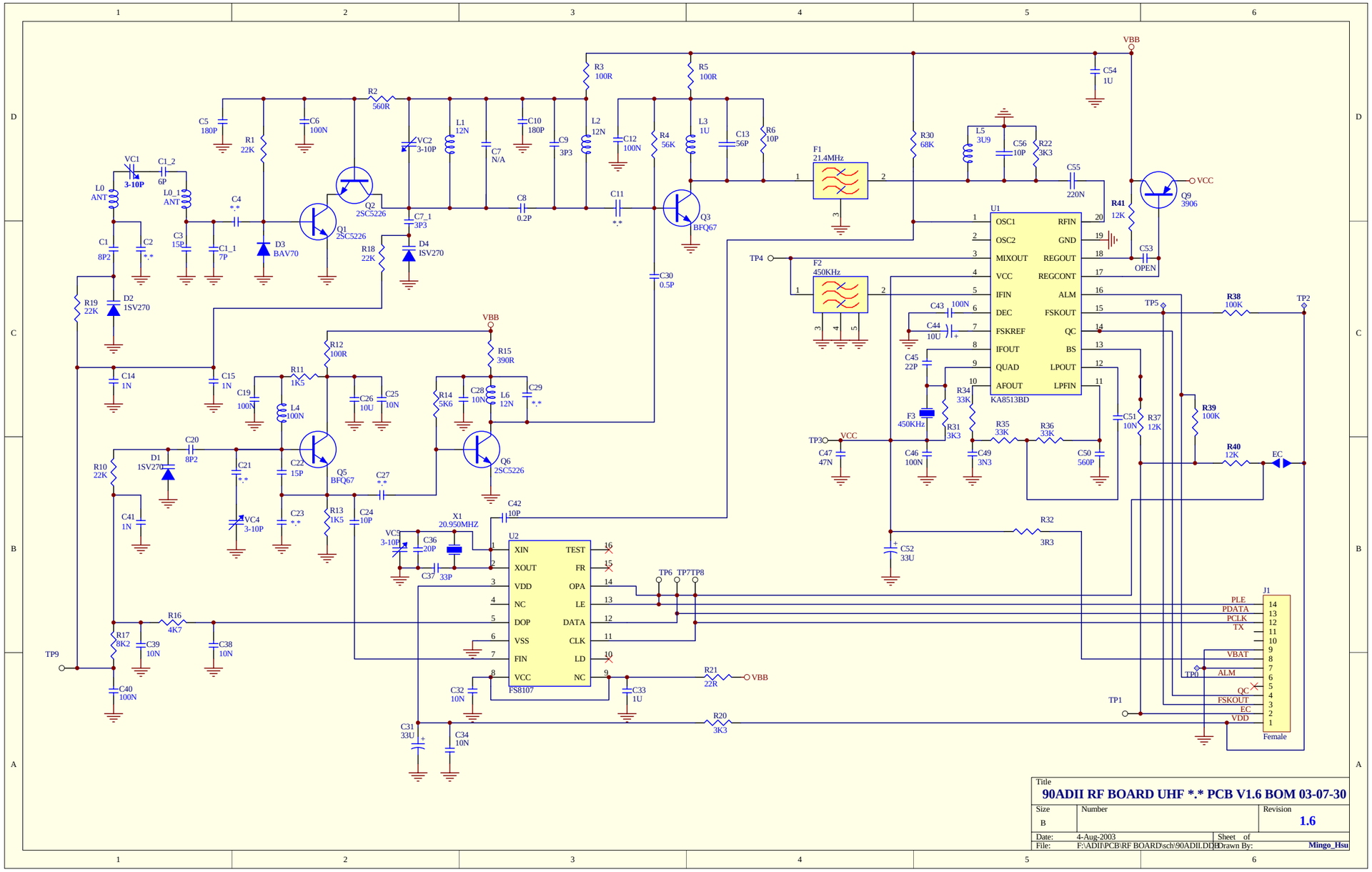


Figure 5-18 Alpha Gold UHF Receiver Board Schematic Diagram

Decoder board Schematic Diagram

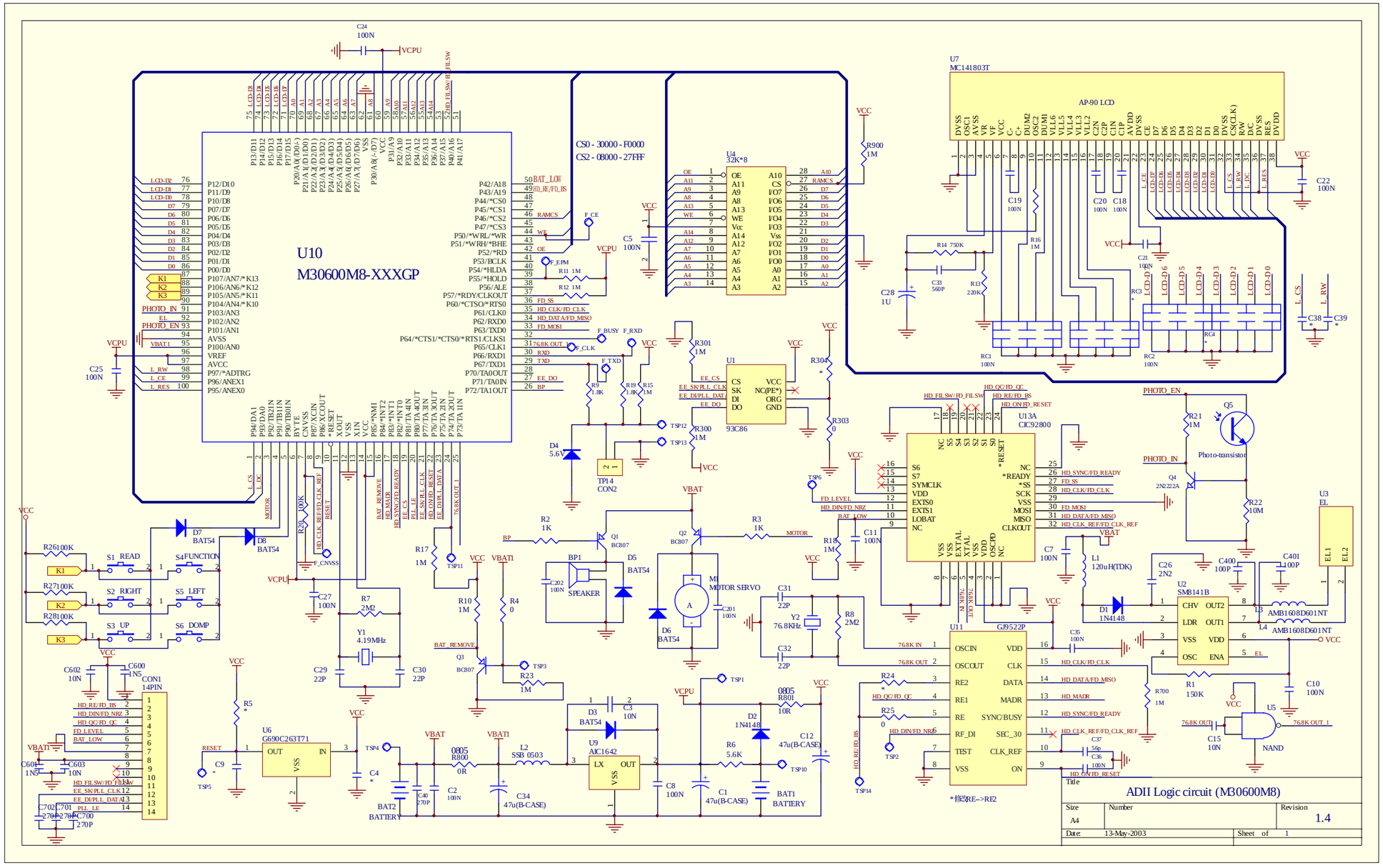


Figure 5-19 Alpha Gold Decoder Board Schematic Diagram